GMO: OMG!

What Everyone Needs to Know

Ocean Robbins

FOOD REVOLUTION NETWORK

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Written by Ocean Robbins

Contributions from Carly Verble, John Robbins, Michael Carwile,
and the rest of the Food Revolution Network Team

Cover design by Alysha Vandergriff

The truth is, in the last 25 years, dangerous changes have taken place that impact how our food is grown – and how safe it is to eat. Most people aren't even aware of what's happening – or are dangerously under-informed.

We don't want that to be you. At Food Revolution Network, we've studied the impact of GMOs extensively, and we've consulted with the world's leading experts on the topic.

We believe that this is one of the critical food issues of our time, and we're passionate about giving you the knowledge you need to be informed, and to protect yourself and those you love.

What is a GMO?

A genetically modified organism, or GMO, is an organism whose genome has been altered by the techniques of genetic engineering so that its DNA contains one or more genes not normally found there. The most common GMO foods have been engineered to withstand being heavily sprayed with toxic herbicides.[1]

Who's Behind GMO Crops?

Five biotech companies account for nearly all the sales of genetically engineered seeds in the world: Bayer (which acquired Monsanto in 2018), Dow Chemical Company, DuPont, BASF, and Syngenta. These companies developed a highly profitable, integrated business model in which the genetically engineered seeds they sell are dependent on the pesticides they also sell, such as Bayer's (previously Monsanto's) Roundup or Dow Chemical's 2,4-D.

For years, these and other biotech companies have been promising that GMOs would reduce pesticide use,[2] increase yields,[3] reduce water consumption,[4] and offer foods that are tastier[5] and more nutritious.[6] Instead, in the 25 years since GMO crops first came on the market, herbicide use has increased by 527 million pounds, putting consumers and the environment increasingly at risk.[7] Other studies have found no meaningful improvement in flavor,[8] nutrition,[9] yield,[10]

or water requirements.[11]

Are GMO Foods Dangerous?

Even though labeling of GMO foods is required in 64 countries,[12] and over 90% of the American public wants GMO labeling,[13] the United States and Canada are two of the only industrialized countries in the world that don't have laws requiring mandatory labeling.

GMO foods have also never been safety tested by the U.S. Food and Drug Administration (FDA) thanks to a 25-year-old policy that says it's up to the biotech companies themselves to determine the safety of GMOs.[14]

In other words, the government agency in charge of protecting U.S. citizens allows biotech companies, which stand to make billions in profits from the mass sale of these crops and corresponding herbicides, to conduct their own "voluntary safety consultations."[15]

The United Nations/World Health Organization food standards group and the American Medical Association have called for mandatory safety testing of genetically engineered foods. The U.S. FDA continues to fail to meet that standard.[16]

In the past, Monsanto (now Bayer) and Syngenta have restricted independent research on their genetically engineered crops. They've often refused to provide independent scientists with seeds, or they've set restrictive conditions that severely limit research options.[17]

However, from the independent studies that have been conducted, GMOs have been linked to a number of health safety concerns, including the presence of new allergens or increased levels of naturally occurring allergens, introduction of plant toxins, and negative changes in nutritional composition.[18]

Considering that most GMO crops have been engineered to be resistant to herbicides, and that since GMO crops have become widespread use of those herbicides on food crops has skyrocketed, the safety of the herbicides is a significant matter.

In 2015, the World Health Organization's International Agency for Research on Cancer announced findings that glyphosate, the main ingredient in Bayer's Roundup line of pesticides, is "probably carcinogenic to humans."[19] The research, published in

The Lancet Oncology, relies on studies conducted on the chemical over the course of several decades.[20]

Since the IARC report was released in March 2015 many countries have been looking at possible bans on glyphosate-based herbicides and Sri Lanka is one of multiple countries to announce a complete ban.[21] Supermarkets across Europe have also removed glyphosate-based herbicides from their shelves.[22]

But these herbicides are still being sprayed, in increasing quantity, directly on genetically modified herbicide resistant crops.

Studies have linked exposure to Dow's 2,4-D to reproductive problems,[23] Parkinson's disease,[24] and an elevated risk of non-Hodgkin's lymphoma.[25] Glyphosate, the active ingredient in Bayer's Roundup, has been found to be a probable carcinogen.[26]

Some research has also indicated that glyphosate may be an endocrine disruptor; has been linked to liver disease, birth defects and reproductive problems in laboratory animals; and may kill beneficial gut bacteria and damage the DNA in human embryonic, placental and umbilical cord cells.[27]

There's also a suspicious correlation between the introduction of GMOs into the food supply and the rise in rates of autism,[28] cancer,[29] and many other ailments.[30] Correlation is not causation. But for many people it is, nevertheless, cause for significant concern.

Which Foods Are Genetically Modified?

The following is a list of foods at high risk of being genetically modified. The best way to avoid GMO foods is to choose organic and/or non-GMO Project verified options with all of these foods.

A high-risk crop or ingredient is “derived from, contains derivatives of, or is produced through a process involving organisms that are known to be genetically modified and widely commercially available.”[31]

These medium-risk food products are being monitored due to known occurrences of GMO contamination or they will soon be widespread.

A low-risk crop “is not derived from, does not contain derivatives of, or is not produced through a process involving organisms that are presently known to be genetically modified and commercially available.

Generally, if a food is not considered high-risk or medium-risk as defined above, then you can be pretty sure that it’s not genetically engineered. Despite the spread of GMOs in our food supply, the reality is that there are thousands of wonderful foods that have never been genetically modified.

Making wise choices takes continued vigilance, as new GMOs enter the market and as new scientific discoveries emerge. But the vast majority of our fruits, vegetables, grains, legumes, nuts, and seeds are still 100% GMO-free.

Crops and Produce

Alfalfa - The fourth largest crop grown in the U.S., alfalfa is primarily used for animal feed, especially dairy cattle.[32] Due to the prevalence of GMOs in animal feed, traces of genetically modified material consumed by animals, as well as of toxic herbicides, can be detected in animal derived products, including milk.[33]

Canola - 90% of the commercial canola crop grown in North America has been genetically modified to be Roundup Ready,[34] making it tolerant of glyphosate — the active ingredient in the weed killer Roundup.[35]

Corn - There are over 142 types of genetically modified corn, the most of any plant species.[36] GMO corn, like Bayer's Roundup Ready corn or Bayer's Liberty Link corn, have been modified to be herbicide resistant and / or to be insecticide producing.[37] [38]

Cotton - Cotton is the second most genetically modified crop with 56 types and it's also designed to be both herbicide resistant and insecticide producing. While cotton is not common in packaged foods, the use of cottonseed oil is becoming increasingly popular in processed foods and in the fast food industry.[39]

Hawaiian Papaya - Papaya was the first genetically modified fruit commercially grown. GMO papaya, known as Rainbow and SunUp or Sunrise, was created to resist the papaya ringspot virus.[40]

Soy - As of 2017, soybean represents 50% of all the biotech crop area in the world,[41] making it the number one genetically modified crop.[42] Introduced by Monsanto in 1996,[43] GMO soybeans are herbicide resistant and pesticide producing. Want to know the most counterintuitive way to take a bite out of the GMO soy industry? Choose beans, or even tofu, over beef. Around 70% of the world's soy is fed directly to livestock,[44] and only 6% of soy is turned into human food.[45] Most of the rest of the world's soy harvest is turned into soybean oil.

Sugar Beets - 50-60% of sugar produced in the U.S. comes from sugar beets – and nearly all of them are GMO. The genetically modified variety created by Monsanto is herbicide resistant and makes up 95% of the commercially grown crops.[46]

Summer Squash - Both zucchini and yellow summer squash have been developed to resist certain viruses that affect squash. While genetically modified squash can only be grown in the U.S., it can be sold in both the U.S. and Canada as fresh produce.[47]

Apple - In November 2017, the first genetically modified apple became commercially available with a limited introduction. The Arctic® Golden Delicious apple, developed by Okanagan Specialty Fruits, is genetically modified to not immediately brown when cut or bruised. (The apple still degrades like any other apple - you just can't tell because the color doesn't change.) There are also plans to introduce non-browning Granny Smith and Fuji varieties.[48]

Potato - The EPA and FDA approved three types of genetically modified potatoes in 2017.[56] These potatoes are genetically engineered to resist the pathogen that caused the Irish potato famine and also have reduced bruising and black spots (this cosmetic change has no impact on actual flavor or potato preservation).

Flax - Genetically modified flax was introduced in 2001 but taken off the market when European importers refused to buy it.[49] In 2009, there was a report of GMO contaminated flax in trace amounts, which is why it is still being monitored.[50]

Mushroom - The first genetically modified mushroom was developed in 2016 by a plant pathologist in Pennsylvania.[51] Similar to apples, the genes in the white button mushroom that cause browning were modified to give the button the appearance of longer shelf life.

Mustard - Mustard was set to be the first genetically modified food to come from India,[52] but due to opposition from activists and politicians, the request to release it was put on hold in October 2017.[53]

Oranges - In 2015, the U.S. Environmental Protection Agency (EPA) gave Southern Gardens, a Florida citrus grower, approval to field test disease resistant trees. The trees would be genetically modified to include a gene from spinach plants that produces a protein that makes them inhospitable to the bacteria that cause citrus greening.[54]

Pineapple - Del Monte received the FDA's approval in 2016 to sell genetically engineered pineapples that will be pink in color. These pineapples, which will be grown in Costa Rica, produce lower levels of the enzymes naturally found in conventionally grown pineapples that convert the pink pigment lycopene to the yellow pigment beta carotene.[55]

Rice - The FDA approved the first GMO rice product developed by Chinese scientists in January 2018.[57] The rice is genetically modified to be insect resistant. So far, as of this writing, neither China nor the U.S. has approved mass cultivation of genetically modified rice.[58]

Wheat - Genetically modified wheat is not grown commercially,[59] however, Monsanto developed glyphosate resistant wheat that was found on a farm in Oregon in 2013 and again in Washington in 2016.[60] [61]

Animal Products

Meat & Poultry - Animal products such as meat and poultry are high-risk due to the prevalence of GMOs in animal feed.[62] Soy, cotton, corn, canola, sugar beets, and alfalfa are the most common commodity feed ingredients.[63]

Milk & Dairy - The genetically engineered recombinant bovine growth hormone (rBGH or rBST) created by Monsanto is still injected into dairy cows in the U.S. to increase milk-production.[65] In order for dairy livestock to receive organic certification, they must meet USDA guidelines, which includes a diet of 100% organic feed.[66] Antibiotics, GMO-derived products, animal by-products and synthetic preservatives are prohibited.

Eggs - Like meat and poultry, hens producing eggs may be given feed derived from genetically modified crops.

Honey - Bees can travel 3-5 miles around a hive to forage for pollen and nectar, making it easy for honey to be contaminated from the pollen of genetically modified crops.[67] Honey may also contain high fructose corn syrup, which is made from GMO corn. As of 2015, honey cannot be certified organic in the U.S, unless it's imported, because the USDA does not have any standards for it.[68] Many local beekeepers, however, still make honey the right way, and would never even think of cutting their honey with corn syrup.

Fish - The FDA approved the sale of farmed genetically engineered salmon in 2015 and it became available for purchase in Canada in 2017. The salmon contains a growth hormone that allows it to grow faster throughout the year compared to non-genetically modified salmon.[64]

Packaged Products

Alcohol - Most spirits, including bourbon, whiskey, and some vodkas, are distilled from corn, which is usually GMO.

Aspartame - The popular artificial sweetener aspartame is made from the excretions of a genetically engineered bacteria.[69]

Ascorbic acid - Also known as Vitamin C or Sodium Ascorbate, the synthesized version commonly comes from GMO corn and is used as a preservative in food. There are also non-GMO options.[70]

Citric acid - Used to provide tartness in some candies and drinks, citric acid is sourced from corn steep liquor, molasses (often made from GMO sugar beets), hydrolyzed corn starch or other inexpensive sugary solutions.[71]

Sodium citrate - The sour flavor enhancer is a form of citrate and made from corn.[72]

Ethanol - Ethanol is made by fermenting sugars produced from corn starch.[73]

Flavorings - Both artificial and natural flavorings can be corn-based.[74] Also there is no legal definition of what "natural" means in food marketing.[75]

High-fructose corn syrup - The controversial and commonly used sweetener is derived through a multi-phase process from corn, specifically corn starch.

Monosodium glutamate (MSG) - MSG is often made from GMO corn. It can also be produced by the fermentation of sugar beets, sugar cane, or molasses.[76]

Hydrolyzed vegetable protein - Another form of MSG, this flavor enhancer is made from maize meal (cornmeal). Other forms can be made from soy or wheat.[77] [78]

Lactic acid - In the synthetic form, lactic acid can be made from chemicals or as a byproduct of corn fermentation.[79]

Maltodextrin or Dextrin - Maltodextrin is a thickening agent made from corn starch.[80]

Molasses - Molasses can either be made from sugar beet juice or sugar cane. Corn syrup may also be present in molasses.[81]

Sucrose - While sucrose can come from both sugar cane or sugar beets, it can also contain corn and in this case will be labeled sucrose (from corn).[82]

Textured vegetable protein (TVP) - Used as a meat substitute, TVP is commonly made from GMO soy.[83]

Xanthan gum - Xanthan gum is grown on corn or corn sugars and used as a thickening agent in many foods.[84]

White Vinegar - The most common way to make distilled white vinegar is from GMO corn, but it can be made from any sugar.[85]

Yeast products - Yeast usually contains Sorbitan Monostearate, an ester of sorbitol (produced commercially by the breakdown of dextrose, also known as corn sugar) and stearic acid.

The Simplest Ways to Avoid GMOs

This list is long, and some people find it overwhelming. But there are a couple simple ways to go non-GMO without having to spend your life stressing out and reading labels.

There are literally hundreds of food additives that many people may not recognize are GMOs when in fact they are.[86] If a product isn't Certified Organic or Certified Non-GMO, and if it has more than five ingredients listed on the label, odds are high that it does, in fact, contain GMOs. But there's good news here, too! As you'll see in the Food Revolution Summit, processed foods aren't just a source of GMOs. They're also a source of heart disease, cancer, type 2 diabetes, obesity, autoimmune disease, chronic illness, and premature death. Saying no to processed foods is one of the most powerful steps you can take on behalf of your health.

You can also go with foods that are certified organically grown. Foods that are certified organic are, by definition, non-GMO and free of glyphosate and many other toxic pesticides. Researchers have found that people who adopted an organic diet for one week saw an incredible 90% reduction in pesticide exposure.[87] Other studies have shown that children who switch to an organic diet will reduce their pesticide load.[88]

What if you can't afford organic food? Keep reading to find out where it matters most!

The EWG "Dirty Dozen"

According to the Environmental Working Group's Dirty Dozen list, the following non-organic produce tests positive for high concentrations of pesticide residue. The items below are listed from highest to lowest amounts of pesticide residue. **These foods are the most important to buy Certified Organic if you can.**

Strawberries - Tests on strawberries found an average of 7.7 different pesticides per sample. Some of the pesticides include: Carbendazim, a hormone-disrupting fungicide that damages the male reproductive system; Bifenthrin, an insecticide that has been designated a possible human carcinogen; and Malathion, which is not only toxic to the nervous system but also a probable carcinogen.[89]

Spinach - Conventionally grown or non-organic spinach had more pesticide residues by weight than all other produce tested. 75% of the samples tested were contaminated with permethrin, a neurotoxic insecticide that is banned from use on food crops in Europe. At high doses, permethrin overwhelms the nervous system and causes tremors and seizures. However, studies have also shown lower-level exposure to permethrin-type insecticides and neurological effects in children, including ADHD.[90]

Nectarines - The highest concentrations of pesticides found on nectarines came from Fludioxonil, a bee toxin. Iprodione, a likely human carcinogen and a hormone-disrupting fungicide, was found on nearly 32% of the nectarines.[91]

Apples - More than 80% of the 708 apples tested positive for Diphenylamine or DPA, a chemical banned in Europe due to concerns it could form cancer-causing nitrosamines during storage.[92] Apples also had high concentrations of Thiabendazole and Pyrimethanil, both fungicides and likely carcinogens, as well as Carbendazim.[93]

Peaches - Peaches had high concentrations of Fludioxonil, a fungicide and bee toxin; Iprodione; Tebuconazole, a possible human carcinogen[94] and hormone disruptor[95]; and Pyrimethanil.[96]

Pears - The highest concentrations of pesticides found on pears belonged to fungicides, which are applied to control fungus and mold. Some of the pesticides detected included: Carbendazim, a hormone-disrupting fungicide that damages the male reproductive system and which was found on 25% of the samples tested; DPA; and bee-killing insecticides.[97] [98]

Cherries - Fresh cherries were found to have high concentrations of Pyraclostrobin and Boscalid, which are both fungicides.[99] According to the EPA, Boscalid shows "suggestive evidence of carcinogenicity."[100] Frozen cherries, on the other hand, had slightly more pesticides than their fresh counterpart.[101]

Grapes - Of the pesticides found on the sample of 708 grapes, over 60% tested positive for Boscalid, while 34% of the grapes tested positive for Tebuconazole.[102]

Celery - The insecticide Methoxyfenozide was discovered on 50% of the celery sample.[103] Acephate and Dicloran, both possible carcinogens, were also present in high numbers (33% and 39%, respectively).[104] [105]

Tomatoes - While more than 25 pesticides were found on tomatoes, they appeared on less than 30% of the sample of 708 tomatoes.[106]

Sweet Bell Peppers - Sweet Bell Peppers tested positive for many pesticides, including Oxamyl, which is poisonous to humans.[107] [108]

Potatoes - Nearly 99% of the potatoes tested had residue from Chlorpropham, an herbicide.[109]

EWG's Clean 15

These non-organic produce items made EWG's *2017 Clean 15* list for being least likely to contain pesticide residue or having low centrations of pesticide residue.

***Sweet* Corn** - Corn's thick husk protects kernels from pesticide applications (only 1% of the sample showed detectable pesticide residue), making it one of the cleanest vegetables.[110] [111] Most corn sold in supermarkets is sweet corn. Unlike field corn, which is a high-risk genetically modified crop, only a small percentage of sweet corn is genetically modified, but it is becoming more prevalent.[112] Want to avoid GM sweet corn? Purchase only organically grown.

Avocados - Thanks to their thick, pesticide-blocking skin, avocados are one of the cleanest fruits you can buy. Only 1% of the sample showed any detectable pesticides.[113]

Pineapples - Few pesticides were found on pineapples, and less than 5% were found to have any residues at all. Their thick skin definitely helps.[114]

Cabbage - Cabbage tested positive for Imidacloprid, an insecticide, in less than 10% of the sample.[115]

Onions - The fungicide Boscalid was only present in 7% of the sample of onions.[116]

Sweet Peas - Frozen sweet peas sometimes came back positive for Dimethoate, which is possibly carcinogenic and may cause reproductive issues.[117]

Papayas - The fungicide Boscalid was found on papayas.[118] Despite their low concentration of pesticide residue, many Hawaiian papayas are genetically modified and should be bought organic if you want to avoid GMOs.

Asparagus - Less than 5% of the sample of asparagus tested positive for pesticide residue.[119]

Mangoes - Mangoes tested positive for Thiabendazole, which presented in less than 16% of the sample.[120] The fungicide is likely to be carcinogenic to humans at high doses. Mango skins provide a strong protective effect.

Eggplant - Both Endosulfan sulfate and Endosulfan II were found on eggplant, but neither are known to be carcinogenic.

Honeydew - Honeydew's thick outer peel protects the flesh from harmful pesticides.

Kiwi - Even though they have thin skin, kiwis are rarely sprayed with pesticides.[121]

Cantaloupe - Pesticides found on cantaloupe were in less than 15% of the sample.[122]

Cauliflower - Deltamethrin and Imidacloprid, were sometimes present on cauliflower.[123] Neither of them are considered to be carcinogenic.

Grapefruit - The highest concentrations of pesticide found on grapefruit was the fungicide Thiabendazole and Imazalil, also a fungicide and likely carcinogen. Imazalil is also known to produce reproductive toxins.[124] But grapefruit's thick skin keeps a lot of otherwise potentially problematic pesticides out.

A Word About Organic

People go organic for all kinds of reasons. Many want to avoid pesticide exposure, or GMOs. Some also want to contribute to more sustainable agriculture, to show respect to farm workers and animals, and to oppose environmental contamination.

But there's no question about it: Organic foods can cost more. For some people, that makes them prohibitive. If buying organic is out of your price range, our advice is to not let that stop you from eating fresh fruits and vegetables! As you'll hear in the Food Revolution Summit, there are thousands of medical studies telling us clearly that eating more fruits and vegetables is associated with a longer and healthier life for just about everyone. Keep in mind that most of the fruits and vegetables eaten in those studies were NOT grown organically. So, don't make the perfect into the enemy of the good. Eat your veggies! And if you can, go organic—especially with the "dirty dozen."

And here's another tip. You can wash your fruits and vegetables! We even wrote an article about how to do it. Check it out at: foodrevolution.org/wash.

Endnotes

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