

The use of genetically modified micro-organisms (GMMs), as well as the chemical compounds they produce, has a universal tacit approval. Whereas, the production of food using genetically modified organisms (GMOs), mainly plants, is vehemently opposed. Some argue that GMO foods are harmful and should not be consumed, while others believe that they can do a lot of good, e.g. reduce hunger in countries facing food shortages and improve the living standards in developing countries. What are the actual benefits of GMOs – and do they carry any risks?

Many of us do not realise how often we come in contact with products created using genetically modified micro-organisms (GMMs). These often include life-saving pharmaceuticals. Prominent examples include insulin used to treat diabetes, as well as interferons used to treat various types of cancer and viral infections such as hepatitis. Thanks to GMM's production of recombinant proteins, such pharmaceuticals are widely available in pharmacies. Food enzymes produced by GMMs, e.g.  $\alpha$ -amylase which breaks down starch, used in the baking and brewing industry, increase the efficiency of food production, providing society with greater food security, i.e. wide access to food products.

Barbara Wójcikowska, PhD, from the Faculty of Natural Sciences of the University of Silesia in Katowice, Chair of the Faculty Committee for GMMs and GMOs, defines the process of genetic transformation leading to the introduction of genetic modification as a technology based on processes occurring in nature. In turn, a genetically modified organism is one into whose genetic material (DNA) one or more genes (called transgenes) have been introduced from another organism: a virus, bacteria, plant or animal organism, using genetic engineering technology.

Is it possible to support the efforts of scientists and accept GMO food products with confidence? The researcher claims that it is.

'Despite the scientific research still being conducted with a view to protect human health, GMO crops or GMO-labelled foods have many opponents', says Barbara Wójcikowska, PhD. 'In highly developed countries, the need to grow GMO crops is not felt at the

moment because there is no shortage of food there. The situation is different where there is poverty, a significant food deficit, or where the cultivation of plants is hampered by environmental factors or diseases caused by viruses, bacteria, or fungi'.


How about some examples? Hawaii is the most important papaya-growing centre in the USA, but for years it struggled with papaya ringspot virus (PRSV), which decimated the crops. The solution came with the genetic modification of the species by introducing a gene encoding the replicase of the PRSV virus, which made papaya immune to it. Due to climate change, more and more agricultural areas are affected by drought causing reduced yields. The genetic modifications carried out to date in maize (Genuity® DroughtGard™), soybean (Verdeca HB4), wheat (HB4), and sugarcane (NXI) are conditioning the crops for increased drought tolerance. And these are just two out of many examples of the potential use of GMO crops. In 2019 alone, some 190.4 million hectares of fields were sown with GMO crops worldwide. 29 countries are involved in the cultivation of transgenic crops, with the United States, Brazil, Argentina, Canada, and India leading the way. The others are mainly developing countries that aim to raise their economic status through GMO plantations (it is worth mentioning that 43 highly developed countries import GMO plants for their food and animal feed production). Currently, it is possible to grow 32 species of GMO crops. However, four of them, namely soya, maize, cotton, and canola, represent as much as 99% of GMO crops. Genetic modification of plants concerns changes in 7 commercial traits, but more than 99% of crops


are plants tolerant to herbicides or pests or having both those qualities at the same time. The cultivation of GMO crops is banned in Poland and such food must be appropriately labelled. The only exception practised is animal feed. For many years, legislation in Poland has postponed the entry into force of a law banning the use of transgenic feed on the grounds that the Polish market would not saturate the demand for non-GMO animal feed.

No reliable scientific studies, or international institutions such as the World Health Organisation (WHO), the US Food and Drug Administration (FDA), or the Food and Agriculture Organisation of the United Nations (FAO), have confirmed that products containing GMOs or produced using GMMs have an adverse effect on human health and well-being.

'GMO foods are just as healthy or unhealthy as any other food', notes Barbara Wójcikowska, PhD. 'It is worth noting that many diseases are not caused by food per se, but by improper diet and eating habits as well as global environmental pollution. Our health is affected by the way we live, the cleanliness of the air we breathe, and the purity of the waters we drink and bathe in. Under such circumstances, it is difficult to say that the observed health problems are undeniably related to transgenic food. If this was the case, the population of Americas, where GMO foods have been consumed on an everyday basis for years, would face enormous health problems. With the lack of GMO cultivation in most countries of the European Union (except Spain and Portugal) and the lack of public acceptance, Europe should be at the forefront of negative control and the population should enjoy much better health on a global scale, which is unfortunately not the case'.



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Many of the genetic modifications are dictated by the desire to eliminate food waste and by restrictive consumer preferences. One such example is the apple, which turns brown when cut in two after a certain amount of time, thus becoming less appealing. The browning of the apple is related to naturally occurring oxidative processes that cause the flesh to change colour. A company in the United States has created a genetically modified apple tree, the Arctic® apple. Its oxidative processes have been inhibited by silencing the gene encoding phenol oxidase, which is responsible for the oxidation of phenols, thus leading to a change in the fruit's colour. As a result, the bitten apple does not turn brown and the juice squeezed from it remains bright at all times.

'Out of the many modifications we may come across, the pink pineapple (Rosé) is one of the more interesting cases. For this modification, the researchers used genes from closely related pineapple species to increase lycopene and carotene content, and simultaneously inhibit ethylene biosynthesis. Thanks to these changes, the pink fruit stays fresh much longer', says the researcher.

The labelling of food products as GMO foods is often equated with them being inferior in quality. People are willing to pay more for GMO-free food products, believing that by doing so they are protecting their bodies from something harmful. The expert says that although there are no confirmed scientific studies on the negative effects of consuming GMOs, the myth of its harmfulness is still alive and kicking.

Genetically modified pink pineapple (Rosé) | Photo: Rawpixel.com  
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# GMO

A NEW HOPE OR THE ROAD TO PERDITION