Genetically modified foods

The efforts of food producers, by which agricultural producers of raw materials are also understood, are to achieve the required quality at a reasonable cost. The growing emphasis on ecology somewhat limits growing, breeding and processing technologies. One way of achieving the desired result is breeding, which aims precisely to improve properties, achieve a higher yield or improve processing.

History

Until the 18th century, breeding was done only by selection, i.e., to sow cultural plants, the seeds of the best individuals were selected. It was a patient selection of natural hereditary changes - mutations (different breeds of dogs, pets, etc.). The second stage was the crossing of different lines within the species, and later different species.Examples include the triticale cereal as a hybrid of wheat and rye. Drastic interventions were often used, such as the use of the ocun toxin colchicine for multiplication of chromosomes or Ionizing radiation to induce mutations. The result was a dismemberment of the hereditary kit and, from the subsequent generation, a selection of the most optimal properties for the purpose. They were methods of trial and error, and the outcome was difficult to predict. No one was concerned about the consequences, although it was not known what was happening in the hereditary basis of the new breeders and what the long-term health and environmental consequences might be.

Present

The last quarter of the 20th century introduced a method of genetic manipulation into breeding, allowing targeted introduction of specific genes into the plant heritable basis to modify the modified organism's characteristics in the desired direction. Genetically manipulated organisms were born. The scientists themselves voiced concerns about the consequences of these experiments, resulting in the formulation of strict rules to control the results, as well as the deepening of the study of mechanisms for self-manipulation and subsequent behavior of their own genetically manipulated organisms, even after their processing into food. At the same time a wave of science fiction literature has picked up, where genetic modifications have provided a suitable theme for disaster scenarios. The genie was released from the bottle.

Gene manipulation spans the genes of target organisms. The term gene refers to a section DNA, deoxyribonucleic acid, that performs a function. It can determine the composition of a single protein, e.g. responsible for the characteristics of the organism. Genes for protein production are quite universal and can be identical for multiple organisms. They are referred to as structural genes. Other genes have a regulating function and only work in a given organism; in others, they are ineffective. The sources of structural genes come from the hereditary basis of other organisms, plants, animals, bacteria or viruses, but they can also be genes synthesized in the laboratory. The gene is made up of phosphoric acid, a string of deoxyribonucleic acid molecules (DNA) or ribonucleic acid molecules (RNA) and four bases: adenine (A) and thymine (T) and guanine (G) and cytosine (C). In RNA thymine is replaced by uracil base (U). These pairs of bases can be understood as elements of a simple alphabet that, according to the sequence of connections, form words, sentences, paragraphs, similar to the font of printers. The gene represents a part of the matrix that carries a certain property and is paired according to the pairing rule into another chain, where deoxyribose is replaced by ribose and called RNA. According to the RNA, the proteins are then formed, which is called gene expression. The regulatory function of a gene is that it marks the beginning and end of a structural gene, thus information indispensable for expression. The regulatory sections have to be the organism itself, where we want to transfer the gene or where it is already active. The general mechanism of gene transmission of a structural gene does not depend on the developmental distance of the donor or DNA recipient.

The total number of genes in plant cell nuclei varies from one organism to another, and is estimated at 20-50,000. In gene manipulations, two well-defined genes are usually injected. This is less of an intervention than in natural mutations in the natural environment, where selection is used.

What's the point of gene manipulation? Above all, it is about improving the genetically manipulated organism's characteristics, which can lead to improved technological properties, resilience, indirect protection of the environment, reducing the cost of producing agricultural raw materials and food, as well as other non-food products. Briefly and clearly, these benefits are:

- increase in crop yields and livestock yields;
- an increase in the nutritional value of the food, the mutagenic properties and the shelf life;
- reducing losses in cultivation and farming;
- reducing the chemization of agricultural production by increasing pest resistance as well as new rassant-like biocides and improved degradability;
- the spread of growing organisms in areas with extreme climatic and soil conditions;
- substitution of chemical processes in the use of renewable raw materials for non-food, pharmaceutical and energy uses;
- improving waste management;
- improving diagnostic and therapeutic procedures including finding the causes of inherited diseases in human medicine.

Practical results of gene manipulations

- Bringing in transgenes for *plant resistance to herbicides'* of a new generation. These herbicides are very effective, but they only affect plants and not animals. When applied to the growth and hit by the weeds, they degrade rapidly, leaving no toxic fumes. Before the development of transgenic plants, they could not be used because they were also active on cultural plants. The effect is that instead of being sprayed multiple times with different herbicides, the growth is treated with a new herbicide once - twice, at a smaller dose. This leads to cost savings, labour savings, diesel (the greenhouse effect decreases).

- **Resistance to plant viruses** is done by introducing a gene that produces a protein that coats the virus (protein coating). The gene directly comes from the virus it is intended to counteract. These viruses are found freely in plant material and consumed daily in relatively large quantities. In a conventional plant, we consume not only mantle protein, but also viral RNA, which is not in the transgenic plant.

- **Insect Pest Resistance** is based on the formation of a protein called delta-toxin, which is produced in nature by the wild bacteria *Bacillus thuringiensis*. This protein is toxic to some insect pests, which is why in the recent past these bacteria have been cultured and applied in the form of spraying to field cultures. Introducing the delta-toxin gene directly into a cultural plant, e.g. maize, has achieved resistance against the corn stirrer, potatoes against the potato almond and its pests in the cotton plant. In transgenic resistant plants, pest losses are eliminated and costs associated with mechanical application are reduced.
  - Bruchus pisorum is capable of destroying up to a third of the pea crop. In spring, the females fly on flowering peas, lay their eggs there, hatch their larvae, eat their way into the pod and burrow into the seed. There, it completes it´s development into an adult beetle and the cycle can be repeated in the spring. Until recently, the solution was to use hard chemistry.
  - Thomas Higgins' team from The Australian CSIRO Plant Industry has developed pea-grain protection games. The bean possesses a gene that produces an alpha-amylase inhibitor. This disrupts the digestion of starch and thus kills bruchus pisorum larvae. The bean's appropriate isolated gene was then implanted with the bacterium *Agrobacterium tumexmlns*, which smuggled it into its DNA. The newly-formed variety withstood bruchus pisorum larvae with an efficiency of 99.5%. Genetically modified games have faced years of testing. Botanists investigated whether the pollen of this pea would pollinate other plants or another representative of the Australian flora would acquire resistance to its natural pest and thus not become an indestructible weed.Toxicologists investigated the possible toxicity of GM peas. It has also been studied whether GM games cause allergies. It turned out that GM peas had modified the inhibitor by surrounding it with other sugars. The altered games irritated the mice's immune system. Not by eating alone, but by injecting or inhaling a pure inhibitor. It was over with GM peas.
  - That was water for the mill of opponents of GM technicians. They said they had long ago said how dangerous GM crops were and genetic manipulation methods were risky and uncertain. Proponents contradicted that eliminating GM peas showed meticulous scrutiny of the results, in addition to the fact that consumerism doesn't matter until injection or inhalation is out of the question in natural conditions. In addition to the same measure, i.e. the creation of a defence against pea grain strain, long-standing and demanding breeding can be achieved without the use of genetic procedures, and nothing is verified there.
  - Alpha-amylase inhibitors are produced by a variety of other plants, such as cereals. And inhaling them triggers allergies and asthma in bakers. At the same time, natural allergens do not require any similar tests for their negative action. For example, hundreds of people die each year from an allergy triggered by commonly sold peanuts.

- **Prolonging the technological durability** of tomatoes was achieved by introducing a synthetic transgene that knocked out the normal tomato gene for polygalacturonase. This enzyme is involved in the final stage of ripening by promoting the breakdown of pectins and softening tomatoes. Gene manipulation, while not preventing softening, has been shown to greatly protect against fetal spoilage, and these have better sensory properties. Another synthetic gene prevented the activity of one of the genes for the production of ethylene, which triggers the maturation process. If no ethylene is produced, the tomatoes do not turn red and do not ripen and can be harvested on bushes all at once large and green and then stored for a longer time. They are then matured in a container to which the ethylene is added. They reach the consumer in optimum quality, fresh and undamaged.

- Part of transgenic plants is intended as *raw material for industry*. For example, a hydroxybutyric acid polymer, which is biodegradable, is starting to be applied in packaging technology. This polymer is a stock of some bacteria, but the gene has been introduced into the rapeseed variety. Rape has also been modified to produce higher erucic acid as a raw material for nylon production, the use of rapeseed in the form of biodiesel is known.

Safety of gene manipulations and gene manipulation products

The road to getting a transgenic plant is a long one. It starts in a laboratory and the process is similar to that of testing new drugs. The variety must pass a very rigorous set of tests prescribed by decree or law, as well as mandatory verification tests. On the basis of carefully kept documentation, the panels of experts then decide on the registration (approval) of the new variety for practice.

In gene manipulation, a so-called selective gene is used to find cells where a transgene has been successfully injected, causing numbness to a particular antibiotic. When antibiotics are added, the tissue cultures are then separated from the cells sensitive to antibiotics, i.e. without the transgene, from those containing the selective gene, i.e. with the transgene. The effect of selective genes is that they encode special enzymes (neomycinphosfotransferase or hydromycinfosfotransferase) that are then incapacitated by the antibiotics involved. One of the objections to the use of transgenic plants was also born here, because they contain a gene with antibiotic resistance, which could create resistance in human medicine to treatments using antibiotics. As a result,

extensive tests were conducted for the toxicity and stability of these enzymes when administered orally. The results showed no adverse effects. In the digestive tract, the enzymes were completely degraded, with no evidence of toxicity. The same happens in the digestive tract of farm animals, fed on genetically manipulated feedstuffs, e.g. maize. It is absolutely well established that no gene from a bacterium, plant or animal can, after consumption, enter the genetic makeup (genome of the consumer (human or farm animal), that is, subsequently into the products of livestock (milk, meat, eggs). In addition, there are more than 1,000 bacteria naturally resistant to the test antibiotic kanamycin in the gut microflora, and the treatment doesn't matter.

Another objection by activists to gene manipulation is the warning of the unknown. The prohibition of transgeneosis is also required in cases where there are demonstrably no consequences of this activity. It is a concern against the spread of so-called non-natural genes in nature. What these voices fail to realize is that it is in nature that new and new genes are generated by mutations, and the composition of natural populations is constantly changing due to selection due to external factors, also due to human activity, but also due to other patterns of population genetics.

Many foods contain allergens, especially proteins, which cause trouble for about 0.5% of the population. To date, GMO proteins have shown no allergenicity in testing with normal routine testing procedures. The exception was the development of GM soya with a higher metionin content as feed for livestock, The gene with Brazil nuts was used, but it also carried allergies to Brazil nuts. Despite the fact that the soya being developed was not intended for human nutrition, development was halted following this finding. Yet this case is used in the argument against GMOs. It is not taken into account, for example, that the verification mechanism discards about 95% of the formulations studied when developing drugs.

Risk prevention

Both scientists' initial concerns and public pressure to eliminate the possibility of health risks and negative effects on the environment have led to the utmost caution in working with GMOs. The U.S. National Institutes of Health (NIH) has been published since Jan. 1976 series of guidelines for working with GMOs. American scientists with advancing experience have shown that fears are unfounded and have convinced US lawmakers that there is no need for special laws for genetic manipulation and their products. In Europe there was pressure from environmentalists, which outweighed the expert arguments, and therefore in r. In 1990, two directives were published in the EU considerably limiting the work and use of GMOs. Since then, they have been amended several times towards liberalisation. Similar measures are being prepared in the Czech Republic. This is the Law on the Management of Genetically Modified Organisms No. 78/2004 Coll. and Implementing Order No. 209/2004 Coll., which aims to provide security guarantees including qualified supervision, but also to open up the possibility to exploit the merits of GMOs and facilitate international trade in this commodity. The law defines GMOs as organisms (except humans) whose hereditary material has been altered by genetic modification. The law defines and regulates the handling of GMOs, the contained handling of GMOs (including their disposal), the introduction of GMOs into the environment and circulation, the risk assessment of the handling of GMOs and determines the risk categories. Under the Law, the IRU is obliged to create and maintain four lists:

- for persons authorised to deal with GMOs in a particular way;
- GMOs approved for contained use;
- GMOs approved for introduction into the environment;
- GMOs approved for circulation.

Requests for inclusion in the lists are approved by the IRU on the recommendation of a panel of experts composed of representatives of the IRU, MZd, MZE and the Czech Commission for the Management of GMO and its Products. GMO specifications cannot be subject to commercial confidentiality, similar to the description of altered DNA. It is further within the law

- safeguarding the education of civil service personnel and other relevant institutions that will come into contact with the issue;
- established system for public information and established cooperation with foreign legislative partners (OECD, EU, UN, CEFTA, etc.).

Economic and political aspects

» Economic and political aspects » GMOs have found applications primarily in the US, where large companies have invested in their development with the aim of expected profits from their sale. There is also interest in GMOs in developing countries and countries at risk of starvation and specific alimony diseases because they allow excellent prevention where normal farming practices do not protect against inadequate nutrition. Europe, with its Common Agricultural Policy, which has been very successful, so today it is quaintly leading to overproduction of food and food raw materials, saw some risk in the GMO programme and therefore the official posts were reticent. Large concerns also played their part here, neglecting awareness and ignoring the seemingly ridiculous opposition to GMO out of ignorance. For example, a lot of people in the gene survey answered that genes have only GMO, not standard non-manipulated organisms, without realizing that a number of "manipulated" organisms have long produced food (triticale, dairy cultures, production insulin in bacterial pathways, etc.). What about feed, soya is now 50% GMO only.

This has turned the health problem into an economic and political problem from GMO. The situation in Europe today is that the US is prepared to file a complaint against the EU with the WHO (World Health Organization) for member states' continued delay in unblocking approval of new GM crops and products thereof. Currently (March 2003), a 4-year moratorium on the approval of GMO products is ongoing. That is why the European Commission is warning member countries to act in this direction. On the other hand, the forced entry of these products into the

European market may add to consumers' aversion to these "novel foods". Europe's negative attitude may continue to spread, reaching a paradoxical rejection of American food aid in Zambia and Zimbabwe, a famine-stricken country.

Links

Related Articles

- Genetic modifications
- GMOs
- Gene manipulation and gene engineering

Source

- PERLÍN, Ctibor. *Geneticky modifikované potraviny* [online]. [cit. 2012-03-11]. <https://el.lf1.cuni.cz/p15141483/>.