Genetically Modified Organisms and Hybridization

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The scientific creations of new foods and plants

The creation of new foods and plants either by genetic modification or hybridization is a topic that has commanded the attention of a great many scientists as well as the general public.

The definition of GMOs encompasses any organism whose genetic material has been altered using genetic engineering. This includes medications, foods, plants, animals--and the list is growing. In 1983 the first documented plants were combined with an antibiotic gene that created a plant that was resistant to a specific disease.

One type of GMO is called a "transgenic organism." This type of genetic engineering alters an organism—seed or plant—by the addition of genetic material from an unrelated organism. It is used in plants to create new flower colors, improve hardiness, or to create a new type of plant. An example of color variation was the development of a "blue" rose, created by cloning genes from a pansy.

In the 1980s plant breeding advanced to the insertion of a plant gene from one species into another. Genetic transgenic modification became a reality, and soon after commercially useful transgenic plants with resistance to herbicides, insects and viruses were developed. Much research using GMOs has been directed toward plant conservation, especially plants and trees that are threatened by extinction.

Genetic modification of seeds has created crops that are resistant to disease and pests, improve nutrient value and more. In areas of the world where people are malnourished, genetically modified foods have the potential to feed millions by vastly increasing production. Despite these positive uses of GMOs, the long-term effects of consumption of genetically modified food are unknown. To better inform the public, there is US federal regulation pending to make mandatory the labeling of foods and food products that contain GMOs.

The process of hybridization, or plant breeding, on the other hand, is not a recent discovery; it has existed for thousands of years. Hybrids are a cross between two species to produce a plant with more vigor or disease resistance, more uniformity, better production, or more unique cultural characteristics.

How does this "cross" happen? Cross pollination can happen without any human help when pollen is blown by the wind or accomplished faster by hand pollination. Plant breeders and

farmers have scrutinized their fields and traveled to foreign countries in search of plants that exhibit desirable traits. They then mechanically combine the pollen in an effort to produce a

better plant. In the 1920's, research began that produced increased numbers of mutations and variations with the use of x-rays. This type of mutation breeding accelerated after World War II when techniques from the blossoming nuclear age became widely available. It was also discovered that chemicals such as sodium azide and ethyl methanesulphonate caused mutations.

A harvester works through a field of genetically modified corn on a dairy farm near Santa Rosa, California, in 2015. Photo by Rich Pedroncelli / AP

Another method of plant mutation is accomplished with the use of plant tissue cultures. Tissue culture is a technique that can be used for growing plants on artificial nutrients under sterile conditions. Most breeders cross-pollinate plants of the same species, but crosses have also been successful with plants from different genera. One such example is a cross between wheat and rye that produced a wheat resistant to several diseases.

How is a genetically modified seed created? Geneticists, engineers and farmers have worked to produce seed that will grow as they hoped it would, an in a way nature may not have intended. First, they identified a trait that they want the plant to have and then research what other organisms have that trait. They then take the gene from the seed of an organism with the trait by "shaving" off a tiny piece of the seed and grinding it into a powder. It is analyzed with genome-mapping technology.

Next, they have to insert the gene into the plant tissue. This is done by various techniques such as heating of a seedling and inserting new proteins into the plant's chromosomes. Now the pollen will have the DNA in its genome and consequently in the seeds that are produced. They test the plants from the newly created seeds for the traits that were desired such as drought- and/or salt-tolerance, pest- and disease-resistance, and more. Then they "field test" the selected seeds under a variety of conditions.

Much of this research and development has now reached the point where public/private partnerships have formed to fund the creation of crops that will survive in places with challenging climates and conditions like very dry places in Africa. Aided by these partnerships, the breathtaking goal of feeding 9 billion people by 2050 may become a reality. The discussion and debate regarding GMOs will continue. Much information is available for the public to review.

RESOURCES:

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