Biofortified GM crops may be a long-term solution to global micronutrient deficiencies

Over two billion people worldwide suffer from micronutrient deficiencies due to insufficient intake of vitamins and minerals. Poor sections of the population in developing countries are particularly hard hit because they often eat staple foods that are high in calories but low in micronutrients. In a new review article, an international research team with participation from the University of Göttingen shows how genetic engineering can help to combat micronutrient deficiencies in the long term. The article was published in the journal Nature Communications.

Micronutrient deficiencies often lead to serious health problems. Deficiencies in vitamin A and zinc, for example, are among the most important risk factors for child mortality, while an undersupply of iron and folic acid can lead to anemia and physical and mental development disorders. Often the people affected do not know that the health problems are due to a lack of micronutrients, which is why there is sometimes talk of “hidden hunger”. The long-term goal must be that all people have sufficient knowledge and sufficient income to be able to eat a balanced diet all year round. However, more targeted measures are also required in the short and medium term.

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biofortification way forward nourishing future

One measure is so-called biofortification, i.e. the breeding of staple food crops with higher micronutrient contents, which smallholders can then plant and propagate themselves. In the past 20 years, international agricultural research centers have developed various biofortified plants using conventional breeding methods, including corn and sweet potatoes with vitamin A or rice with a higher zinc content. These crops are now grown in numerous developing countries with proven nutritional and health benefits. However, conventional breeding methods have certain limits.

In the article, the scientists explain how genetic engineering can help to further increase the effectiveness and usefulness of biofortified plants. “With genetic engineering approaches, significantly higher micronutrient contents can be achieved in the plants than with conventional breeding methods alone. We have already shown this for folic acid in rice and potatoes, ”says first author Prof. Dr. Dominique Van Der Straeten from Ghent University. “We have also succeeded in significantly reducing the vitamin losses after the harvest.”

Another advantage of genetic engineering is that high levels of different micronutrients can be combined with one another in the same plant variety. “This is important because poor people often suffer from various nutrient deficiencies at the same time,” says co-author Dr. Howarth Bouis from the International Food Policy Research Institute. Genetic engineering also makes it easier to combine high levels of micronutrients in the plant with new agronomically relevant properties, such as drought or pest tolerance, which are becoming increasingly important in light of climate change. “Farmers shouldn’t have to decide whether to grow varieties that are either nutrient-rich or have stable yields. Combining both aspects in the same varieties is important and can contribute to widespread use, especially in the smallholder sector, ”says co-author Prof. Dr. Matin Qaim from the University of Göttingen.

The scientists are aware that many people view genetic engineering with skepticism, even though the plants developed in this way are safe for the environment and human health. One of the reasons for the negative attitude is that genetic engineering is often associated with large agricultural corporations. “Biofortified plants could help to increase acceptance because these plants are specially developed for the benefit of poor population groups,” the authors say. “Public funding and support are particularly important for this.”

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