Plant genetic engineering to fight hidden hunger

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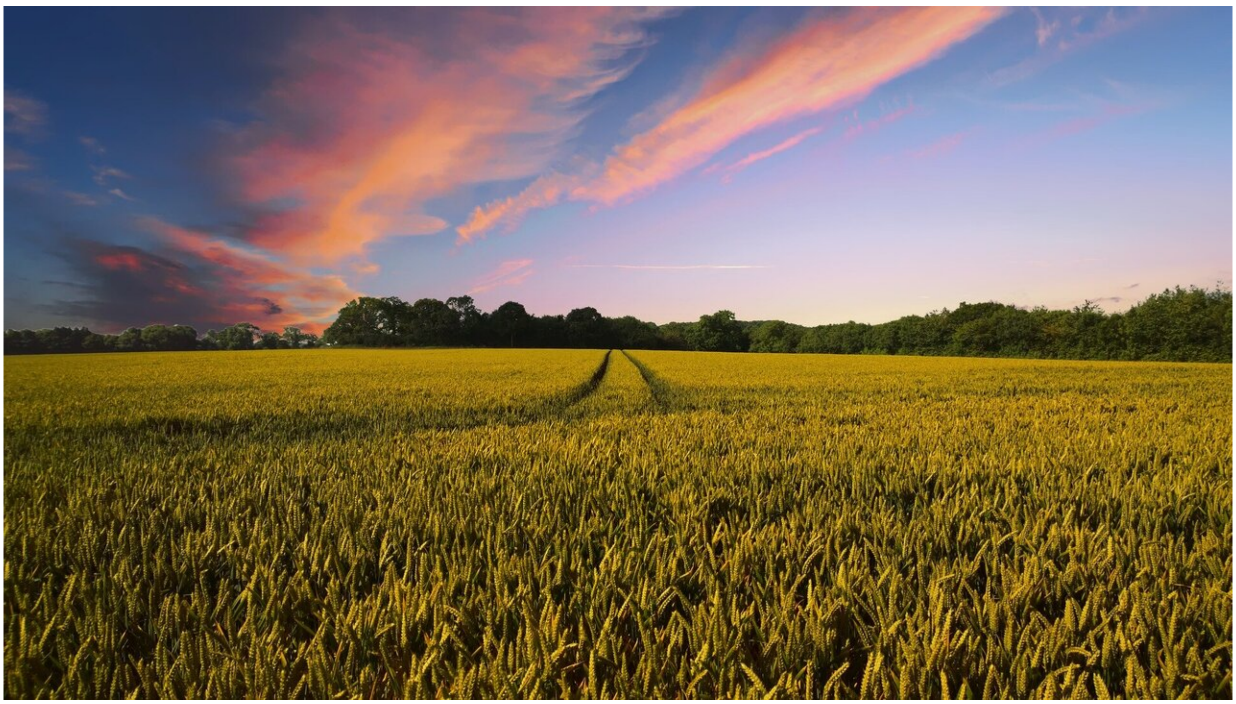

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More than 2 billion people worldwide suffer from micronutrient malnutrition due to deficiencies in minerals and vitamins. Poor people in developing countries are most affected, because their diets are typically dominated by starchy staple foods, which are inexpensive sources of calories but contain low amounts of micronutrients. In a Perspective article recently published in *Nature Communications*, an international team of scientists explains how plant genetic engineering can help to sustainably address micronutrient malnutrition.

Micronutrient malnutrition causes severe health problems. The highest numbers of people affected by mineral and vitamin deficiencies live in Africa and Asia. For instance, vitamin A and zinc deficiency are leading risk factors for child mortality. Iron and folate deficiency contribute to anemia, physical and cognitive development problems. Often, the people affected are not aware of their nutritional deficiencies, which is why the term 'hidden hunger' is also used. The long-term solutions are that all people are made aware of healthy nutrition through education, and raising incomes so that all can afford a balanced diet all year round. However, more targeted interventions are required in the short and medium term.

One intervention is to breed staple food crops for higher micronutrient contents, also known as 'biofortification." Over the past 20 years, international agricultural research centers have developed biofortified crops using conventional breeding methods, including sweet potato and maize with vitamin A and wheat and rice with higher zinc contents. These crops were successfully released in several developing countries with proven nutrition and health benefits. However, conventional breeding approaches for biofortification have limitations or are not possible in several other staple crops..

In the *Nature Communications* perspective, the scientists report how genetic engineering can help to further enhance the benefits of biofortified crops. "Transgenic approaches allow us to achieve much higher micronutrient levels in crops than conventional methods alone, thus increasing the nutritional efficacy. We demonstrated this for folates in rice and potato," says Dominique Van Der Straeten from Ghent University in Belgium, the paper's lead author. "We also managed to reduce post-harvest vitamin losses significantly," she adds.

Another advantage of genetic engineering is that high amounts of several micronutrients can be combined in the same crop. "This is very important, as poor people often suffer from multiple micronutrient deficiencies," says co-lead Howarth Bouis from the International Food Policy Research Institute and 2016 World Food Prize winner. For example, the team at ETH Zurich simultaneously increased iron, zinc and provitamin A in rice.

Genetic engineering can also help to combine micronutrient traits with productivity-increasing agronomic traits, such as drought tolerance and pest resistance, which are becoming ever more relevant with climate change. "Farmers should not have to make difficult choices between crops that either improve nutrition or allow productive and stable harvests. They need both aspects combined, which will also support widespread adoption," say the authors.

In addition, they acknowledge that genetic engineering is seen skeptically by many, even though research shows that the resulting crops are safe for human consumption and the environment. One of the reasons for the public reservations is also that genetic engineering is often associated with large multinational companies. The authors conclude: "Biofortified crops may possibly reduce some of the concerns, as these crops are developed for humanitarian purposes. Public funding is key to broader acceptance."

More information: Dominique Van Der Straeten et al. Multiplying the efficiency and impact of biofortification through metabolic engineering, *Nature Communications* (2020). DOI: 10.1038/s41467-020-19020-4

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