

Biotechnology for Sustainability

How can the nutritional value of agricultural crops be increased?

Supplementation and fortification of food products have been in use for decades, such as iodine added to salt or vitamin D to milk. However, lack of adequate nutrients in the human diet is still responsible for millions of deaths each year, mostly in developing countries. In recent years, scientists have been very successful in enhancing a plant's nutritional properties in a process known as biofortification. Unlike food fortification that requires the purchase of commercial foods, biofortification offers consumers in rural areas the ability to produce higher-nutrient foods that stay within the community. This is a relatively new technique, using plant breeding and genetic engineering techniques to enhance the nutrient content of staple foods. Biofortification is a long-term strategy, as there are high costs to develop and test these enhanced crops. However, once these crop varieties are released, continued investment will no longer be required and large numbers of people will benefit from increased nutrition in products they consume.

Significance

Biofortification is a potentially cost-effective and sustainable way to increase a crop's nutritional value. Evidence thus far has shown that biofortification of crops can contribute significantly to reducing inadequate nutrition in countries throughout the world. While it appears this effort will be cost effective compared to the methods of supplementation or fortification of foods, genetically engineered traits which benefit consumers have not yet moved into commercialization. Community awareness and information dissemination of these new products will be important in moving these foods to market, as was the case when bread fortification was instituted. However, linking agriculture and public health through improved nutrition can enhance consumer health, prevent disease and save lives.

Crops to Watch

Traditional breeding techniques have been utilized to increase the levels of nutrients a crop is already producing to a small degree. However, these techniques are quite limited and do not allow sufficient biofortification in the majority of crops. Here are two specific examples of work that is ongoing in the area of crop nutritional enhancement through the use of genetic engineering.

Golden Rice – Vitamin A deficiency is found in ~40% of young children in developing countries that depend on rice as their primary food, contributing to over 2 million deaths each year. Golden Rice was developed to accumulate beta-carotene, the precursor to vitamin A, in the rice grain. This rice provides sufficient vitamin A to meet the recommended daily allowance and would be distributed without patents or royalties in developing countries. Golden Rice is currently under final development to meet regulatory requirements.

Soybean Oil – The demand for soybean oil has increased steadily and currently accounts for about 60% of the total vegetable oil consumed in the U.S. Through the use of genetic engineering, soybeans have been produced to contain healthier oils, including omega-3 fatty acids and decreased saturated fats. Cooking oils with higher omega-3 fatty acids that are generally derived from fish would improve nutrition and reduce pressure on fisheries. Modification of oil composition can reduce the need for hydrogenation of oils and eliminate trans-fats. Soybeans with improved oil composition are currently being marketed.

SEED · BIOTECHNOLOGY · CENTER

UCDAVIS
DEPARTMENT OF PLANT SCIENCES
College of Agricultural and Environmental Sciences

ASPB education foundation

UC Davis Seed Biotechnology Center (530) 754-7333 http://sbc.ucdavis.edu