Increased Nutrient Content through Use of Transgenic Crops: A Way to Improve Nutrition for All

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Introduction

Malnutrition threatens human health on a global scale.. In the face of a population of 10 billion by the year 2050, immediate action is needed to ensure proper nutrition for all. If current hunger trends continue, 840 million are predicted to go hungry by this time. One pillar of malnutrition is termed hidden hunger; defined as a lack of vitamins and minerals from the diet. It poses a variety of health risks for all populations. A proposed solution to this problem is increasing the nutrient content in staple crops, that sustain populations globally, through genetic modification. Genetic modification is defined as changing the genetic sequence, or the DNA, of an organism. Transgenic modification is one example of this technology. Transgenic modification by nutrient amplification is a solution that will not only feed 10 billion but also *nourish* 10 billion.

Purpose

- Gain an understanding of transgenic modifications with an aim at increasing nutrients in target crops
- Analyze research on increased amino acids, vitamin A, vitamin C, iodine, and iron content in various crops

Transgenic Modification

- Extract DNA that codes for the desired trait (ex. increased Vitamin A)
- Incorporate DNA into *A. tumefaciens* plasmid
- Incorporate plasmid into target crop
- Breeding and cultivation of crop lines follows

Presentation of Research

Historical Development and Current Status

- Genetic modification dates to as early as 8000 BCE
- Traditional modification used breeding methods like selective breeding or cross breeding
- 1947 – Genetic modification studies broke new ground with transgenic discovery
- GMO technologies are used in agriculture currently to improve crop yield and mitigate pesticide usage (among other aims)
- One current focus of genetic modification aims to increase nutrient content in staple crops

Micronutrients

- Vital micronutrients in the human body maintain crucial metabolic processes
- Essential amino acids, vitamins and minerals are all micronutrients that are required from dietary intake

Controversy

- Society and science has long debated GMO usage in agriculture
- Advocates focus on the need and potential benefits of modified organisms
- Critics focus on potential adverse environmental effects and inconclusive research on crop safety
- However, it is crucial for society to accept GMOs in coming years

Golden Rice

- Vitamin A deficiency is the single most important cause of childhood blindness in developing countries
- Transgenic modification created β-carotene dense rice
- β-carotene is a precursor to Vitamin A in the body
- ”Golden” - describes the yellow from β-carotene
- Golden Rice has been ready for distribution since 2002
- Distribution was delayed due to GMO controversy

Conclusions

- Nutrients such as amino acids, vitamin A, vitamin C, iodine, and iron have been found in amplified amounts in various staple crops
- Food yield will need to expand due to growing demand brought on by population increase
- Food security will depend on the improvement of crop nutrients
- Nutrient enhanced crops could also have the potential to prevent disease
- It is important to find the best way to increase nutrient densities in staple crops to meet growing population demands

Recommendations & Future Research

- Multidisciplinary efforts are required to lessen the effect of ailing health on human populations
- Further research is needed to find target genes that will amplify desired nutritive factors in crops
- Research into the safety of crops after genetic alteration
- Research into health benefits of transgenic crops beyond meeting nutritional requirements could improve health for all
- Regulation and standardization of transgenic crops is urgently needed