Raising a large family takes its toll on the bank account, especially when it comes to the grocery bill. With six mouths to feed, I'm always looking for a good deal, but not at the cost of quality. With all the talk surrounding the use of GMO foods, I believe it's worth the extra dollar to avoid possible health issues down the road.

In a world where agricultural food production relies heavily on science and technology to grow mass amounts of plant-based foods, finding safe and reliable food sources can be a challenge. Because plants are the foundation of all of our food sources, in order to meet the high demands of the agricultural industry, our society has become dependent upon genetically engineered foods without regard for health or nourishment quality[1].

Now, spectral analysis of chloroplast pigments offers a new technology that unlocks the secrets to improving food quality without resorting to the use of genetically modified organisms. Spectrophotometric technology reveals the natural growing processes of plant-based foods and sheds a light on new methods for **improving both production and nutritional value in our foods** without the added risks associated with GMOs.

The push for non-GMO ingredients is driving the agricultural industry to look for new options in farming technology to keep up with consumer demands. Image Source: Flickr CC user neetalparekh

The Advantages of Chloroplast Genetic Engineering

Research in genetic engineering began in the 1960s as a way to improve crop resistance to herbicides, pests, and diseases[2]. As new scientific methods developed, breakthroughs in genetically modified foods increased the production and quantity of crop production. Although these genetic mutations did improve resistance to many of the major problems associated with agricultural

development, the risks associated with these mutations quickly began to surface, forcing engineers to look for other alternatives.

Biotechnology research reveals that spectral analysis of chloroplast pigments is an effective way to engineer plant varieties that are resistant to herbicides, insects, disease, and drought. Image Source: Flickr CC user U.S. Department of Agriculture

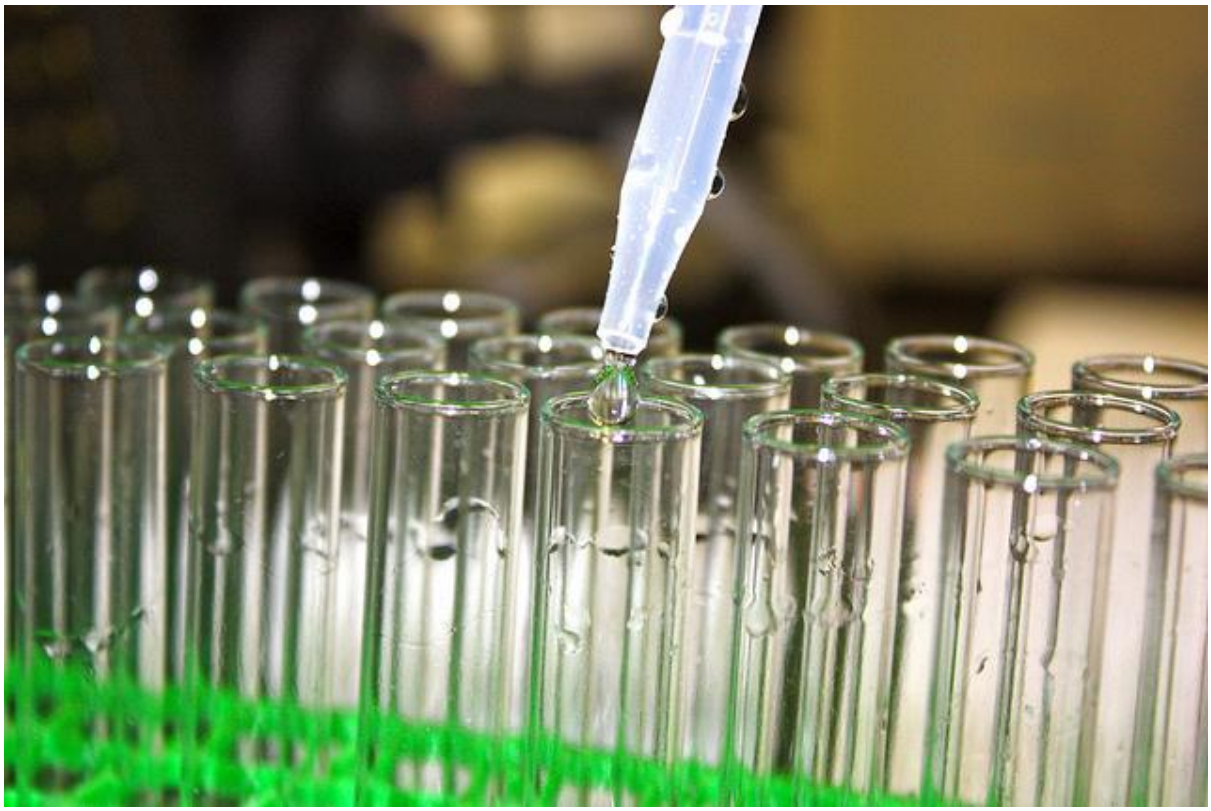
Biotechnology research in **chloroplast pigment analysis** is now at the forefront of environmentally friendly alternatives to genetically modified foods. Chloroplast pigments are the stars of new research strategies as scientists link these energy-production cells to plant structure and resilience. According to the NCBI (National Center for Biotechnology), "Recent success in engineering the chloroplast genome for resistance to herbicides, insects, disease, and drought, and for production of biopharmaceuticals, has opened the door to a new era in biotechnology"[3]. By analyzing the chloroplast pigments in plant cells, scientist can now develop new methods for engineering higher quality foods – naturally.

Chloroplast Pigment Analysis and Color Technology

The molecular structure of chloroplast pigments can be identified and measured by the absorption of visible light. Chlorophyll is the color-producing element found in the thylakoid plate of the plant chloroplast, which can be quantified through the use of **UV/VIS spectroscopy**. Spectrophotometers offer the ability to measure various wavelengths of visible light and the absorption peaks in different color ranges to evaluate chloroplast pigments and provide the information needed for plant structure analysis and modification. Chlorophyll a, chlorophyll b, and total carotenoid content can all be determined through the use of spectrophotometric instrumentation and quantified for evaluation and comparison of genetic properties and changes during modification.

Spectrophotometers can also measure the rate of photosynthesis by monitoring variations in light wavelength change. Since chloroplast pigments are a representation of the energy producing

molecules found in plant-based foods that are produced and multiplied through the photosynthesis process, quantifying these changes provides important information about the genetic properties in plants. By measuring and comparing the rate of photosynthesis in plant pigment samples with the absorption spectra of chlorophyll, it's possible to monitor variations from plant to plant. This form of analysis can provide the data needed for safely modifying foods by utilizing the natural structures of plant-based energy.



Monitoring photosynthesis and chlorophyll levels in plant-based samples with spectral assessment provides useful data toward new biotechnology developments. Image Source: Flickr' user NASA ICE

Innovative Technology in Food Production

Spectral analysis has many applications in food production and is leading the way in agricultural and farming technology worldwide. Chloroplast analysis is merely one of the many applications that color technology offers in this industry. Spectrophotometers offer the versatility to monitor safety and quality at every stage of food production. From providing the quantitative analysis of the micronutrients needed to improve soil quality to monitoring growth rates, water supplies, and final color assessment, spectrophotometers offer the portability and versatility needed in this vast industry.

HunterLab is an expert in agricultural color technology and provides a variety of options for every stage of food production. Our staff is committed to developing new and innovative solutions to help improve both quality and production. That's why many of the world's major food producers rely on HunterLab to ensure the safety and quality of their products. For more information on the many applications of spectrophotometry in the agricultural industry and the variety of product choices we offer, **contact us today**.

1. “What does GMO mean?” Aug. 8-14,

   2016, http://whfoods.org/genpage.php?tname=dailytip&dbid=345

2. “Chloroplast Genetic Engineering, a novel method to produce therapeutic proteins,” 2006, http://www.hcs.harvard.edu/~hsr/wp-

   content/themes/hsr/pdf/pdffall2006/gaglani.pdf

3. Milestones in chloroplast genetic engineering: an environmentally friendly era in biotechnology,” Feb.

   2002, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3476055/