Several years ago, food writer Susan Russo wrote a piece about the color of corn for NPR and destroyed everything I thought I knew about corn. In her writing, she details the summers her family spent driving through country roads in Rhode Island in search of freshly harvested corn. "Often my dad would get out, check the corn and walk back empty-handed, declaring, 'Not yellow enough. It won't be sweet,'" she wrote. I, having grown up on the East Coast and in the Midwest, completely agreed.[1] But then Russo moved to Southern California, where the bright yellow of East Coast corn was in short supply and farmer's markets were instead filled with white kernels. "It was then that I learned a harsh, real-world truth: Some people think white corn is sweeter than yellow." Despite her initial skepticism, she goes on to find that corn color is a product of carotenoids, which have no bearing on sugar levels. In other words, despite the fierce beliefs of corn consumers all over the United States, flavor cannot be predicted based on hue and millions of us have most likely been making purchasing decisions based on inaccurate, regionalized understandings of corn cultivation.

Selective Breeding for Optimal Corn Color

Russo's piece vividly demonstrates how our assumptions about the correlation between corn color and taste are shaped by our environments and, while they may be based on myth, conjecture, and plain lies, they nevertheless deeply inform our preferences and culinary experiences. To ensure that consumer preferences for specific corn and corn product color are satisfied, food processors and retailers therefore specifically seek out "clean, brightly colored corn" in the hues customers are drawn to, despite the fact that color may have no bearing on taste.[2] As such, corn breeding programs are designed in part to optimize color performance for particular consumer groups, thereby maximizing visual appeal and marketability. However, visual assessment of corn is inherently subjective and laborious, and may not produce the degree of accuracy necessary to closely analyze the color behavior of particular breeding strategies.

Spectrophotometry provides an objective, non-destructive basis for measuring and categorizing corn color and can play an integral role in evaluating corn breeding practices. As a study on spectrophotometric color measurement of corn published in *Cereal Chemistry* notes:

Accurate objective methods to evaluate yellow and white corn color would help breeders select appropriately colored corn for processing. Nondestructive methods for evaluating color are important in breeding programs because of small sample sizes available for analysis.

HunterLab's sophisticated spectrophotometric instruments can account for the geometric properties and irregular shape and size of corn kernels to precisely quantification of color information. The data collected can be used to create a comprehensive picture of the chromatic implications of corn breeding strategies, allowing researchers and farmers to tailor agronomic practices to suit their purposes.

The Challenges of Corn Biofortification

Designing breeding programs for specific corn color isn't just about profits; it can be critical to promoting public health and preventing disease, disability, and death resulting from inadequate vitamin A intake. Vitamin A deficiency is one of the most common nutritional deficiencies worldwide, causing blindness in 250,000-500,000 children each year and increasing the risk of contracting and dying from common childhood diseases.[3] The ability to increase provitamin A carotenoids, such as beta-carotene, in corn via biofortification combined with corn's relative affordability has made it one of the primary sources of vitamin A around the world, particularly in regions facing acute nutritional deficiency, such as Africa and South-East Asia. However, as carotenoids increase, corn changes from white to yellow.[4] While for some Western consumers, this color change may be welcome with open arms, the history and cultural perception of corn color in parts of the developing world make the shift problematic, potentially hindering public health efforts.

In many African countries, including South Africa, yellow corn has historically been used primarily or exclusively as animal feed. This practice reportedly began due to the increased risk of rancidity presented by carotenoids, creating a sharp distinction between yellow and white corn in the eyes of consumers that endures even as improved food processing and handling techniques have largely removed rancidity concerns. As plant breeder and genetic engineering researcher Matthew DiLeo says, "This pattern was likely established for practical storage reasons, but now many (especially more wealthy) Africans have a strong cultural preference for white corn."[5] As a result, the yellow corn provided through Western food aid programs has become regarded by many as an insult, often making aid recipients perceive that they are receiving animal food while simultaneously establishing a sensory association between the yellow hue, poverty, and disenfranchisement. Researchers and public health officials hope that education initiatives aimed at reframing corn color perception will eventually increase receptiveness to yellow biofortified corn and facilitate anti-deficiency efforts.[6] Others, however, have a different plan.

Expanding the Possibilities of Corn Color

Provitamin A carotenoids are capable of creating color shifts beyond yellow, as greater levels of biofortification result in corn that takes on an intense orange color. Not only does this increase the vitamin content of the corn and demonstrably improve vitamin A body stores, it also creates a new sensory experience that does not bring with it the troubled history of yellow corn.[7] A team of researchers led by Alex Winter-Nelson at the University of Illinois have experimented with the acceptability of the new orange corn and have observed promising results:

Just over a year ago, Winter-Nelson and one of his graduate students took some of this orange corn to an open-air market in Mozambique for a taste test. The market-goers still preferred their white corn, but almost half of them agreed to exchange it for bags of orange corn when they heard it was more nutritious.[8]

By modulating carotenoid levels to create a chromatically unique product, scientists are hoping to introduce biofortified corn and corn products even in historically unreceptive markets, thereby improving public health. Spectrophotometric monitoring of color data facilitates this process and ensures that the hues produced meet the standard for cultural acceptability, enhancing lives in a direct and meaningful way.

Full article with photos available here:

https://www.hunterlab.com/blog/color-food-industry/biofortification-challenges-using-objective-corn-color-measurement-protect-public-health/