



## Evolution of Tomato Reference Standards and the HunterLab Certified Tomato Tile

For more than 60 years, tomato processors have relied on physical reference standards to ensure consistent, comparable color measurements across laboratories, plants, and instrument platforms. Historically, this system depended on two governing bodies—the USDA (United States) and the BCR/IRMM (Europe). Today, both organizations have discontinued the materials and programs required to maintain their standards, leaving the global tomato industry without an authoritative reference.

This summary outlines the historical discontinuation of legacy standards and the development of the HunterLab Certified Tomato Reference Standard - Tomato, the only viable, traceable, environmentally compliant solution available today.

### Origins: USDA Soft Standards and the First Instrumental Tomato Color Method

The history of instrumental tomato color grading began when USDA partnered with HunterLab in the late 1950s to create the first *Direct-Reading Tomato Colorimeter* standardized using a tomato-colored ceramic tile known as the USDA-TC Standard

By the 1970s, U.S. processors used porcelain-enameled steel USDA/UC-Davis tiles, which were assigned relative to USDA-approved soft tomato paste standards prepared at UC-Davis (8.5 °Brix). These soft standards provided the true calibration reference for TPS equations and tile assignments

However, USDA discontinued production of these soft standards, leaving the industry without the foundational reference required to create new USDA-type tiles

### The BCR-400 Tile (1991): Europe Creates Its Own Standard



In 1991, the European Community Bureau of Reference (BCR) produced a ceramic tomato paste reference tile (CRM-400), calibrated for 12 °Brix plum tomato paste. All BCR tiles were produced and calibrated only once, in a single batch in 1991

The BCR system was independent of USDA:

- It was not referenced to a USDA soft standard.
- Its calibration was performed by the National Physical Laboratory (NPL) in the UK, not UC-Davis or USDA

By 2015, Europe had exhausted the supply of BCR tiles and offered no plan for replacement, leaving the international market without a European governing body or update process

## RoHS Regulations: Why USDA and BCR Tiles Can No Longer Be Produced

A major turning point came with the European Union's Reduction of Hazardous Substances (RoHS) directives:

- RoHS 1 (2003) and RoHS 2 (2011) banned heavy metals—including lead, mercury, cadmium, and hexavalent chromium—used in red pigments essential to the USDA metal tiles and BCR ceramic tiles.
- As a result, neither USDA tiles nor BCR tiles can be manufactured today, because their original red shades cannot be legally reproduced

This created a dual global crisis:

- The EU abandoned support for the tomato tile program.
- The USDA stopped producing soft standards, making USDA-based tile calibration impossible.



## The Industry Left Without Governing Standards

By the mid-2010s:

- **No new USDA metal tiles** had been produced since 2014 (last tiles actually received by HunterLab were in 2009)
- **BCR had permanently discontinued tile availability**, and offered no recertification service
- **USDA no longer responded to HunterLab's repeated requests** for new soft standards or oversight
- **The EU/JRC provided no successor to BCR-400** and effectively withdrew from tomato color governance.

With both USDA and the EU disengaged, the global tomato industry was left without:

- A maintainable standard reference tile
- A soft standard program
- A governing body to support TPS, a/b ratio alignment, or cross-instrument agreement.

## HunterLab's Response: Development of the HunterLab Certified Tomato Reference Standard (2015)

Recognizing the growing crisis, HunterLab took action.

### A. Creating a modern, RoHS-compliant tomato tile (2015)

In 2015, HunterLab designed a new ceramic tomato tile using non-hazardous pigments, engineered to approximate the a/b ratio of the BCR-400 tile while providing long-term durability and environmental safety.

This became the HunterLab Certified Tomato Reference Standard – Tomato.



## B. Independent NIST-Traceable Calibration

HunterLab sent the prototype tiles to the National Institute of Standards and Technology (NIST) for measurement, establishing traceable calibration with uncertainties—something neither USDA nor BCR tiles could offer

Every certified HunterLab Tomato tile today ships with:

- NIST-traceable assigned values
- Documented uncertainties
- Certification valid across instrument platforms

## C. Attempts to Engage USDA

Despite repeated outreach to USDA:

- HunterLab received no response for nearly a decade, from 2014 through 2024.
- Even when USDA finally contacted HunterLab in late 2024, they did not follow through, citing budgetary limitations and repeatedly delaying meetings

## Reconnecting to USDA TPS: HunterLab + Ingomar Partnership (2021–2023)

Beginning in 2021, HunterLab partnered with **Ingomar Packing Company** to reconstruct the USDA assignment method for TPS:

- The team compared legacy USDA tiles at **8.5 °Brix** with BCR and HunterLab tiles at **12 °Brix**.
- HunterLab developed new hitch values enabling the new tile to correlate with historic USDA TPS scores on LabScan XE, Agera, and ColorFlex EZ instruments.
- Field-validated results confirmed excellent agreement, with differences well under 1 TPS unit



In March 2023, HunterLab presented the results to the California League of Food Producers – Research Division, demonstrating successful correlation to legacy USDA scoring

## Critical Industry Guidance: Proper Hitching and Brix Levels

### A. Hitching Must Match Tile + Instrument

TPS equations differ between instrument types:

- LSXE uses different TPS equations than ColorFlex EZ.
- Therefore, a USDA tile assigned to LSXE cannot be used to hitch a ColorFlex EZ or Agera—doing so produces incorrect TPS values

This mismatch has caused real commercial disputes, including multimillion-dollar losses reported by processors.

### B. Tile Type Must Match Brix Level

- USDA tiles were developed for 8.5 °Brix soft standards.
- BCR-400 tiles were designed for 12 °Brix paste.

Using a tile at a Brix concentration outside its intended design will give incorrect a/b and TPS values

## Today: The Only Viable Tomato Reference Standard

Because:

- RoHS bans prevent reproduction of USDA and BCR tiles,
- USDA no longer provides soft standards,



- BCR has ceased production,
- No governing body (USDA, EU, ISO) has replaced these programs,

the HunterLab Certified Tomato Reference Standard is now the only globally viable, traceable, environmentally compliant tomato tile capable of standardizing modern spectrophotometers for:

- a/b ratio
- Tomato Paste Score (TPS)
- L\*, a\*, b\* values
- Cross-instrument agreement

This tile is the only current reference standard that can serve as a replacement for both USDA and BCR-400 tiles

## Summary

The evolution of tomato reference standards reflects the collapse of USDA and EU support, compounded by environmental regulations and the disappearance of legacy materials. HunterLab has stepped into this vacuum by:

- Reconstructing the historical standards,
- Creating a RoHS-compliant modern tile,
- Calibrating it through NIST,
- Validating USDA-TPS equivalence through industry partnerships,
- And ensuring the industry can continue to measure tomato color accurately.

Today, the HunterLab Certified Tomato Reference Standard - Tomato is the sole supported, traceable, and technically valid tomato color tile available worldwide.