AMERICA FLIRTS WITH TRUE TOMATO FLAVOR

Heirloom Tomatoes Rebound in the Market

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It is 1949 in America.

*War-weary but hopeful vets and their young families opt for the promise of new homes and new communities - in **S**uburbia.*

*Mobility is assured by **S**uperhighways.*

*Convenience is guaranteed by **S**upermarkets.*

*Three "**S**'s" that will shape the future of the modern commercial tomato.*

These three S's define the macro-conditions that gave rise to the modern tomato. It's a good-looking fruit, uniform in size and attractive in its full color. Bred for the transcontinental truck trip on the new interstate highways, it holds up well – far longer than those old-fashioned tomatoes. The supermarket shelves offer perfection in presentation and consumers are gradually but willingly convinced that nature has at last been outsmarted. There is just one unsolved problem. The tomatoes have no flavor. A genetic anomaly resulting from intensive breeding efforts has compromised their ability to produce sugars[1]. They barely taste better than the cardboard boxes in which they are shipped.

Heirloom Origins

What sort of tomatoes were popular before the war? We should first bear in mind that tomatoes were a seasonal crop way back when. They were grown locally at the rural edges of towns and in the nearby countryside. Welcomed as a transient seasonal treat their fragility and short shelf life was universally assumed and accepted. Varietal names like Box Car Willie, Mortgage Lifter, Brandywine, and Marvel Stripe attested to generations of backyard breeders and seed savers dedicated to selecting an outstanding and unique flavor profile. The legacy of those pioneers, who largely labored for the love of their produce, almost became a lost chapter in American horticultural folklore with the onset of the Three S's.

The central issue was that the Heirloom Tomatoes (HLTs) and their contemporary hybrids of the age couldn't make the long trip east and nor would they survive extended residence on supermarket produce shelves. Professional plant breeders engaged their postwar challenge with determination. Their wish list of desirable criteria included elevated yield, resistance to various plant pests and diseases, extended harvest, and high color with lasting firmness. Flavor was relegated to secondary status. It was understood that by checking off the priority items both growers and supermarket buyers would be satisfied. Consumers would appreciate a firm and full color fruit and would forgive and eventually accept the insipid taste. The novel varieties came to be known as Long Shelf Life tomatoes (LSL) [2].

The era of the superhighway innovation in '50s America was greeted by maximized expansion of the trans-continental supply chain. California's LSL tomatoes could now reach any suburban market via Eisenhower's highway network. By 1960, a tractor-trailer originating at the West Coast would now reach the Midwest or the Northeast within three or four days[3]. Florida and California together formed the basis for a year-round supply to rapidly expanding markets

and paved the way for Mexico to play its critical role in establishing a season-less, twelve-month market.

Thus the standard was set for decades to come. The fresh and cosmetically flawless fruit delivered no flavor at all but it was reliably available, 24/7/365, with guaranteed arrival.

Ultimate Tomato Flavor; Organic Origin

Among the American generations who have come of age since the 1950s few have ever tasted authentic tomato flavor. Save for an outlier group of home gardeners, who preserved their precious inheritance, Heirloom Tomatoes were unknown in recent times to the general public until the arrival of commercial organic farming, a phenomenon that did not gather critical mass until the '90s. The well-bred tomato had acquired privileged status in the supermarket produce section and in fast food chains yet its iconic appearance, albeit flavorless, became a metaphor for dumbed-down contemporary food and a placeholder for its exquisite antecedents.

Organic production of HLTs was the logical point of departure for introduction into the mainstream of commerce. The first order of business was defined by a niche economy of scale. The fresh tomato industry has acquired mammoth status by 2014[4], making the LSL ubiquitous in retail markets. The new heirloom pioneers had to seek a niche for success and the freshly conceived organically grown market offered just that. The emergence of the organic supermarket trade elevated the demand for organic produce. Consumers showed their preference for produce grown without chemicals. By the 1990s, a critical mass of organic-themed supermarkets and co-ops had emerged and offered HLTs a permanent commercial destination".

"Black from Tula" cultivar

With it came recognition that "organically-grown" implies a departure from the cookie-cutter standards of the conventional supermarket. Misshapen produce lacking uniformity was not only tolerated – it was esteemed by consumers for its authenticity. That was good news for HLTs. An essential characteristic of HLTs is their eccentric shape. While they generally conform to standard tomato shape, many display unusual variance, despite the fruit's fundamental soundness and quality. Even today the USDA has no inspection standards for HLTs and they often use the specs for conventional tomatoes. Invariably the best-selected boxes of HLTs fail the test. Typical box inspections show 80-90% are rated misshapen, uniformity of size is rarely achieved, and minor defects and blemishes are abundant. Supermarkets still

prefer to offer "normal" tomato shapes but consumers have become more accepting and that trend undoubtedly influences the burgeoning "ugly produce" movement[5], an effort to promote sale of physically-nonconforming but sound produce that is otherwise wasted.

Eccentric Shapes

The USDA standards do not assay flavor – if so, HLTs would likely win a gold medal[5]. While taste evaluations are generally a blend of science and subjective judgment by professional tasters, HLTs typically weigh in at 8 to 12 points Brix – well ahead of standard tomatoes. Research also indicates a pivotal role for the volatile compound Geranial[6], uniquely present in abundance in HLTs and thought to play a key role in enhancement of sugars. In any case, consumers seem to be unanimous in their nomination of HLTs as the tomato flavor favorites.

Careful selection and constant exchange of proven varieties had long been the rule among pre-modern gardeners. The inevitable result were mouth-watering iterations of a fruit with formidable pest and disease vulnerabilities[7]. While its shortcomings disqualified the cultivars from the race to the suburban supermarkets uniqueness of flavor gave it a blank check for entry into the modern culinary universe.

The embrace of organic consumers welcomed HLTs in their return to public commerce after a fifty-year absence but the significance of organic production for HLTs eluded producers, retailers, and consumers. We recall that the evolution and development of HLTs took place in the absence of synthetic fertilizers or industrial pesticides. Thus the HLT's development occurred under explicitly *organic* circumstances. Slow-release fertilizers of organic origin promoted optimal physiology of the HLT plant,

permitting flavor compounds and sugars to maximize their expression. HLTs grown with industrial fertilizer readily take up available nitrogen only to expand too rapidly and suffer cracking and subsequent rupture, rendering the fruits unmarketable. Some unscrupulous “organic” producers do use industrial fertilizers to give them an edge – such chemicals cannot be detected by organic inspectors – but they invariably face severe cracking. It’s nature’s way of telling them to toe the organic line. Plant biology teaches us that a plant’s roots cannot distinguish between nitrogen ions from organic sources and those from industrial sources, but the rate and quantity of uptake differ considerably. The HLT is inherently an organic product – it performs optimally as such.

A Riot of Cultivars in Each Box

Commercial cartons contain 4-5 cultivars

Among the most challenging features in the commercialization of HLTs is managing their condition. The standard package of HLTs contains mixed varieties. The luxury of cropping a single cultivar that can be picked at the same moment for uniform ripening is not an option. The mixed pack was probably initiated to feature this novelty of novelties among tomatoes. In any case it seems to be here to stay, at least for now. Mixing varieties in a single package complicates condition management. Most HLT varieties are tender when ripe – some are truly soft. This violates the reigning standard for marketable tomatoes – firmness rules.

Producers, for their part, have complied by selecting those few varieties, out of hundreds, that hold up well during shipping and storage. “Holding up well” is a relative term, but a few days of shelf life is sufficient, provided that the fruit has not been subjected to extended and unfavorable shipping conditions. Timing of harvest is critical. Purples (or Blacks, as they are known) ripen quickly and need to be picked green. Yellows hold well after picking and can be harvested at high color. Brandywine Pink is intermediate in its ripening habit. A combination of tomatoes of different colors, ripening at their own speeds produces a constantly changing kaleidoscope of color and a range of fruit firmness, a constant headache for conventional produce managers, and a moment of vexation for the adventurous consumer.

Packing HLTs for shipping

HLT "wannabees" and a Future of Flavor

By 2010, HLTs had become established as a required commodity in sophisticated supermarkets around the country. Demand for organically grown produce had achieved a steady annual sales growth rate of 15-20%[8]. Most of the major national chains had installed dedicated counter space for organic produce and added to it every year. A minority of chains requested and stocked organic HLTs. Most of them were indifferent to the distinction between organic and conventional HLTs. This resulted in a surge of conventional (not organic) production, from both the U.S. and Mexico. Despite retailers' blind purchasing habits (taste had not mattered much to them during the entire postwar era) HLTs were becoming known again.

Success of HLTs in the market has created a buzz that's irresistible to some growers. At first blush, an eccentric-looking tomato that brings 50% to 150% greater than the market price for standard tomatoes looks like an invitation to a grower to jump in and take advantage. New growers enter the market annually, only to be confronted by the complexities of the challenge. The relatively low percentage of marketable fruit that results is daunting, and only those committed to stay in the chase for the long haul persist.

Young Plant, Young Fruit

HLTs had also attracted the attention of breeders seeking to cash in on the phenomenon. Of course the wannabees ignored the basic facts that Heirlooms were just that – varieties of yesteryear that have been preserved for posterity. GMO technicians made a strategic attempt to enhance anthocyanin (nutritional flavonoids) content of red and purple tomatoes but left consumers unconvinced about their culinary qualities and safety. In any case, HLTs are already rich with flavonoids. Conventional breeders have been successful in mimicking HLTs, releasing some varieties that resemble them and include some enhanced disease resistance as well. There may be an additional market niche for these but their explicit inauthenticity discourages classification as HLTs. Those breeders who nevertheless succeed in creating cultivars that retain flavor while nullifying disease and pest susceptibility are likely to replace currently popular HLT favorites. Eventually they will succeed and a new generation of Heirlooms with reliably improved yield and ease of production will emerge.

Innovative Disease & Pest Control

Varietal selection does not offer the determinative influence that is provided by modern hybrids. Virus and nematodes remain significant hazards to optimal production. Grafting has become increasingly popular utilizing resistant rootstocks[10], which are likely to be modern in origin. Grafting can relieve threats from *Fusarium*, *Verticillium,* Bacterial Wilt, Tomato Mosaic Virus (TMV), and nematodes. Strict hygiene protocols must be applied in the case of TMV, a virus that has nearly ceased to be a problem among hybridized tomatoes. A grower with thirty years of experience producing LSL hybrids was astonished and unprepared – he'd never seen it before. Soil solarization under plastic cover is another effective control for both nematodes and virus and it's regularly used for that purpose in conjunction with grafting. The contemporary trend is to produce HLTs in the greenhouse or net house environment where pest exclusion dominates as a pest control tactic.

Trellised Rows of HLTs in a Net-House

Produce Managers' Knowledge, Consumer Education

Heirloom Tomatoes exist in a market devoid of information. Organic HLTs must, by law, be clearly labelled, as must their country of origin. Beyond that, there is no indication of variety or ripening protocol. There is nothing to prevent conventional tomatoes from being commingled on the Heirloom shelf and indeed this may happen from time to time. The dearth of regulatory standards available for evaluating Heirloom quality contributes to the confusion.

Consumers are confused, with good reason. Their principle source of information, the supermarkets' produce managers themselves, are largely ignorant and uninformed about the product. Their default interpretive benchmark for HLTs is conventional tomatoes. That is a blueprint for misleading the public. Fruit readiness for eating and buying exemplifies the issue. When LSL tomatoes turn tender they are typically removed from the shelves since tenderness is interpreted as an indication that it has passed the freshness threshold. HLTs should be allowed to develop some tenderness on the shelf – it is the indicator of readiness to buy and eat. Customers' agreement to this transaction will guaranty their satisfaction and repurchase. Among other challenges faced by consumers, including learning to distinguish among the presented varieties, to discriminate against high vs. low acid varieties, and to accept green-ripe varieties.

Progress will be slow. This niche industry is not represented by a unified group. Neither growers nor marketers nor consumers have organized to represent this burgeoning item. No funds are available for consumer education or promotion. A full generation of converted consumers may be needed to change the status quo of HLT consciousness and reconfigure demand for tomatoes with flavor.

Geography is also a determinative factor in the HLT demand equation. With the exception of localized farmers' markets, most HLTs reach commercial markets on the east or west coasts and major urban centers. Distribution tends to skew in favor of high-end markets. Discontinuities in supply, demonstrated by seasonal lack of availability in both domestic and foreign production zones complicate this issue. There has nevertheless been a boomlet of interest and publicity celebration the Heirloom.

Heirloom Tomatoes and Its Influence on Commercial Produce

The emergence of HLTs in commercial markets brings a deeper message. It signals an unarticulated consumer dissatisfaction with the cookie-cutter format for produce that we have become accustomed to. It delivers the *sine qua non* of every culinary item – flavor. It implies a message of relevancy to organically grown procedures. It challenges the consumer learn about the product she's eating. Embracing these challenges may well shift the center of gravity for policy in the produce industry.

Annotations:

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2) Postharvest Technology of Horticultural Crops, Adel Kader, Publication 3529 , University of California Agricultural and Natural Resources. PDF of 3rd edition 2011. P.419.
3) "Federal-Aid Highway Act of 1956: Creating The Interstate System", *by Richard F. Weingroff, Public Roads magazine, U.S.D.O.T.,* Office of Research, Development, and Technology, Office of Corporate Research, Technology, and Innovation Management , https://www.fhwa.dot.gov/publications/publicroads/96summer/p96su10.cfm
4) "Fresh Tomato Production and Marketing Trends in the N. American Market", Dr. Roberta Cook, Dept. of Ag and Resource Economics, University of California, Davis April 2015
5) "Walmart Brings Muscle to the 'Ugly' Produce Movement", By Tracie McMillan, National Geographic, July 21, 2016. http://www.nationalgeographic.com/people-and-culture/food/the-plate/2016/07/wal-mart-joins-the--ugly--produce-camp/
6) "Why Heirloom Tomatoes Taste So Good", by Ferris Jabr, Scientific American, August 1 , 2012. http://www.scientificamerican.com/article/why-heirloom-tomatoes-taste-so-good/
7) "Taste: Unraveling Tomato Flavor", by Alan B. Bennett. Current Biology, Vol.22, Issue11, June 5, 2012. http://www.cell.com/current-biology/fulltext/S0960-9822(12)00409-5
8) "Challenges Of Growing Heirloom Tomatoes", Utah Pests News Quarterly Newsletter, UP News Fall 2013 http://utahpests.usu.edu/htm/utah-pests-news/utah-pests-news-fall-2013/challenges-of-growing-heirloom-tomatoes/

9) U.S. organic sales post new record of $43.3 billion in 2015, May 19, 2016, Organic trade Association press release, https://www.ota.com/news/press-releases/19031#sthash.S9ncEuan.dpuf, https://www.ota.com/news/press-releases/19031

10) "Grafting for Disease Resistance in Heirloom Tomatoes", Cary Rivard & Frank Louws, N.C. Cooperative Extension Service, September 2006

PHOTO GALLERY:

HLT pack ready for the retail shelf

Eccentric HLT shapes.

HLTs on retail promo.


HLTs ready for wholesale distribution.


Spectrum of HLT cultivars.

HLTs on the vine

CONTINUED BELOW

Ripening “Green Stripe”

Ripening “Black from Tula”

Net house fully planted & staked.


ORGANIC
HEIRLOOM
TOMATOES