

# The New World of Plant Breeding



**Dr. Dave Clark**  
**UF-IFAS**



# Background on Coleus

- Origin: Indonesia
- Descendants from *Coleus blumei*
- **Coleus** - from the Greek “koleos”, meaning sheath
- **Blumei** - named for Karl Ludwig Blume (1796-1862), a Dutch botanist





# Botanical Classification

- Family *Lamiaceae* (mint family)
  - Genus: *Plectranthus*
  - Over 150 species of *Plectranthus*
- Recently re-named *Plectranthus scutellarioides*
- An allotetraploid ( $2n=48$ )



# Early Breeding Attempts



NEW VARIETIES OF COLEUS.  
For descriptions and prices, vide page 24.



NEW COLEUS.



COLEUS PICTUS.  
For description and price, vide page 3.

(source: British Museum of National History, London, UK)

- First introduced by Dutch traders mid-1800s
- First breeding attempt 1880 – William Bull
- Popular among Victorian era gardeners



# An Artist's Tribute to Coleus



**Vincent Van Gogh**  
**“Coleus Plant in a Flower Pot”**  
**Paris, 1886**



# UF Coleus Breeding Program

- Program established in 2003
- Mostly open-pollinated seeds
- Recurrent Mass Selection
- Selections and establishment of **vegetatively propagated cultivars**





# Coleus

- **Amazing genetic variability**
- It is very promiscuous
- It has inbreeding depression but readily self pollinates
- **It is a tetraploid with active transposons**



# Main Research Objectives

- Make 'tough idiot-proof' plants
- Brighter colors with less fading
- Superior branching & habit
- Late flowering cultivars
- Train tomorrow's plant breeders





# 2013 Spring Crop

35,000 → 1,000 → 300 → 5\*





# Recurrent Mass Selection

- Collection of seeds and seed planting - Fall
- Growth of ~ 35,000 seedlings - January
- 1<sup>st</sup> round of selection at five weeks for bright color





# Selection Process

- **2<sup>nd</sup> and 3<sup>rd</sup> rounds of selection for bright and novel color, plant vigor, branching, and late flowering**



**Dark color, poor branching**



**Bright color, vigor, and branching**

# More selection...





# More selection...





# Lots of Plants





# Fewer Plants





# Field Trials

- Pine Acres (sun) and Gainesville (shade)
- Data collection
  - Plant Vigor
  - Propagation
  - Color consistency
  - Plant consistency
  - Flowering time
  - Health



**Citra, FL**

# Pine Acres – Citra, FL

## A few weeks later





# Pine Acres – Citra, FL

## Late summer





# On-campus – Gainesville, FL





# Bright Colors – Less Fading

**SHADE**



**SUN**



**Out of the gene pool...**

# Bright Colors – Less Fading

**SHADE**



**SUN**



**'Electric Lime'**



# Vision: Bring New Color Into Trailing Types

**'Red Queen'**



**X**







**Sedona**



**Red Queen**



**F1 Hybrid – H66**



**F2 offspring– Copper Penny**



# New Trailing Varieties with Brighter Colors





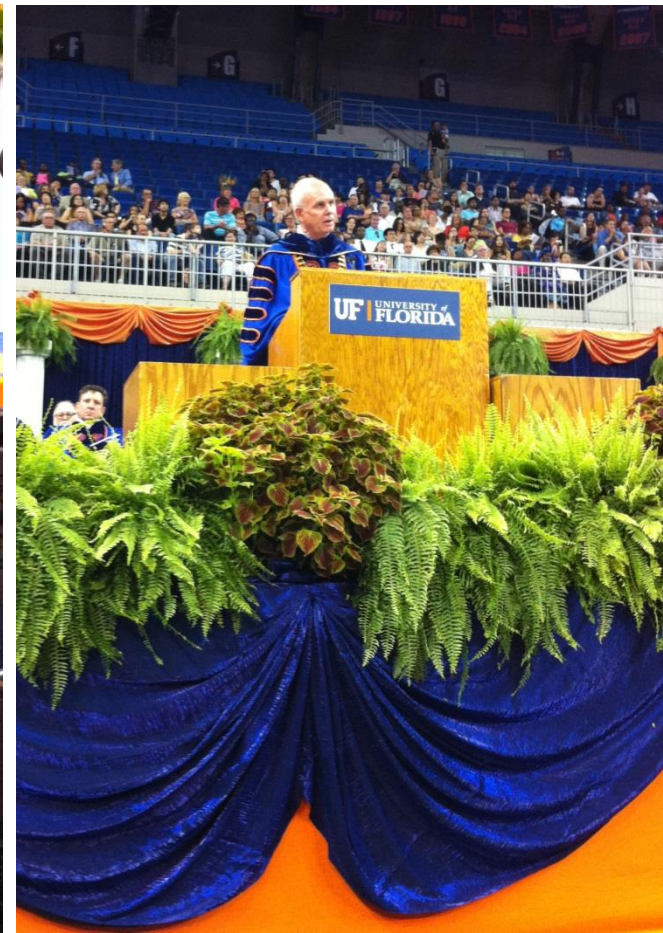
**Our latest release**



**'Gator Glory'**



# 'Gator Glory' – 2013 UF commencement





# Our 2013 Crop – 600 new varieties





A close-up photograph of a large number of flowers, likely gerberas, in shades of bright pink and magenta. The petals are densely packed and feature prominent dark, almost black, spots and streaks, creating a variegated or 'painted' effect. The background is a soft, out-of-focus blur of similar colors, emphasizing the texture and detail of the foreground blooms.

**Some popular UF  
Releases!!**



# 2006 Releases



**'Royal Glissade'**



# 2006 Releases



**'Twist and Twirl'**



# 2006 Releases



**'Electric Lime'**



# 2007 Releases



**'Splish Splash'**



# 2007 Releases



**'Pineapple Splash'**



# 2007 Releases



**'Velvet Mocha'**



# 2007 Releases



**'Big Red Judy'**

# My Friend Judy...



**Judy Brashear  
Biltmore Asheville,  
NC Summer 2011**



**2009 Release**



**'Trusty Rusty'**

# 2009 Release



**'Red Head'**



# 2009 Releases



**Guess which  
redhead is my  
favorite?**



# 2010 Release



**'Alligator Tears'**



# 2011 Release



**‘Wasabi’**

# 2011 Release



**'Sultana'**



# 2011 Release



**'Keystone Kopper'**

# 2012 Release



**‘Marooned’**



# 2013 Release



**'Golden Dreams'**



# Coleus Intangibles



Our Smokin' Hot BBQ Guide

Summer's Best Recipes

50 New ideas for steak, chicken, tomatoes, corn, peaches, and more!

Secrets to Happy Roses

4 Ways to Perk Up Your Porch

Easy Icebox Pies

Perfect Beach Treats THE SOUTH'S MOST CHARM



Pots of 'El Brichto' coleus look dazzling with 'Nikko Blue' French hydrangeas.

## Fall in Love with Coleus

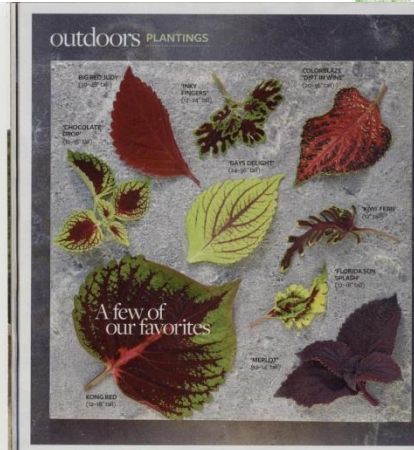
A zillion colors and shapes combined with new sun and drought tolerance make these annuals irresistible

It's almost impossible not to grow coleus. There are just so many colors, forms, and sizes—one you will absolutely love is bound to catch your eye. Some grow big and bushy. Others trail along the ground or cascade over the sides of a basket or pot. Leaf edges may be smooth, toothed, frayed, scalloped, or deeply lobed. And talk about color! Leaves can be solid or may combine three or four colors into psychedelic patterns.

David Clark knows as much as anybody about breeding coleus. Since 2003, he's been conducting trials with 40,000 new plants a year at the University of Florida in Gainesville. Many of the new and exciting selections of coleus you see at garden centers came out of his program. David has added several new traits to the old kinds of coleus to improve tolerance to drought, sun, and heat—creating even better plants. Turn the page to see our favorites.

BY STEVE BENDER. PHOTOGRAPH BY VAN CHEN/PL

\$2 SOUTHERN LIVING JUNE 2012



outdoors PLANTINGS

A few of our favorites



**Better Homes and Gardens.**  
 APRIL 2012 BHG.COM  
 How to Give Your Home  
**easy spring style**  
 with Color, Fabric, and Pretty Seasonal Projects

20 Top Picks and Plants for Gardens  
 9 Smart Ways to Organize Your Family Room  
 plus:  
 - Best Reader Recipes  
 - Kitchen Storage Boost

Creamy Fresh Coconut Cake! A Spring Classic p.202

food safety Expert Tips to Protect Your Family



READER SHOPPING

**Easy, Colorful Coleus**

The hottest foliage plant of the last decade, Coleus brings brilliant color all summer long to borders and containers. Mix and match these six varieties as you choose—you simply can't go wrong in a partly sunny location. One plant each of 'Dye in Wine', 'Henna', 'Mist Mocha', 'Redhead', 'Royal Glissade', and 'Sedona'. Our exclusive collection sells for \$39.95 plus shipping.

join the Marcal movement

help Tim in his crusade for a **GREENER EARTH**

TO ORDER THE COLORFUL COLEUS COLLECTION, ITEM #BHG004, CALL WHITE FLOWER FARM, 800-566-5674, or visit readershopping.com. Please order early; quantities are limited. Ships in jumbo pots from mid-April through June. Sorry, we are unable to ship to APO/FPO addresses, or addresses outside the contiguous United States.

Tim Spring



# Coleus Intangibles



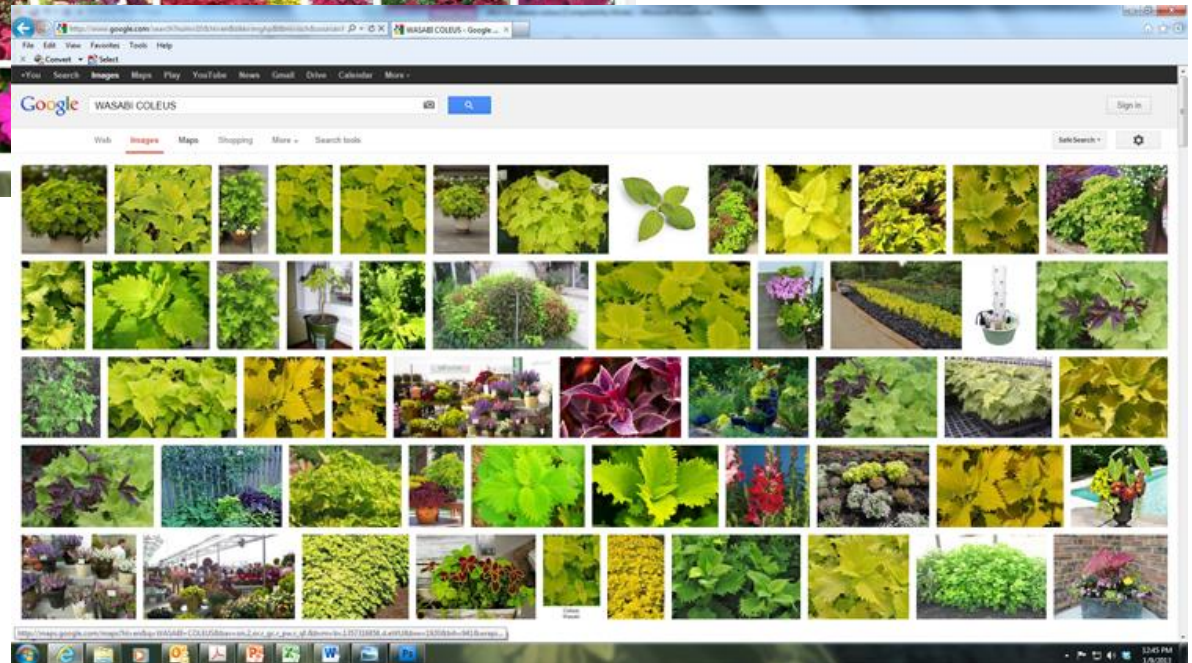
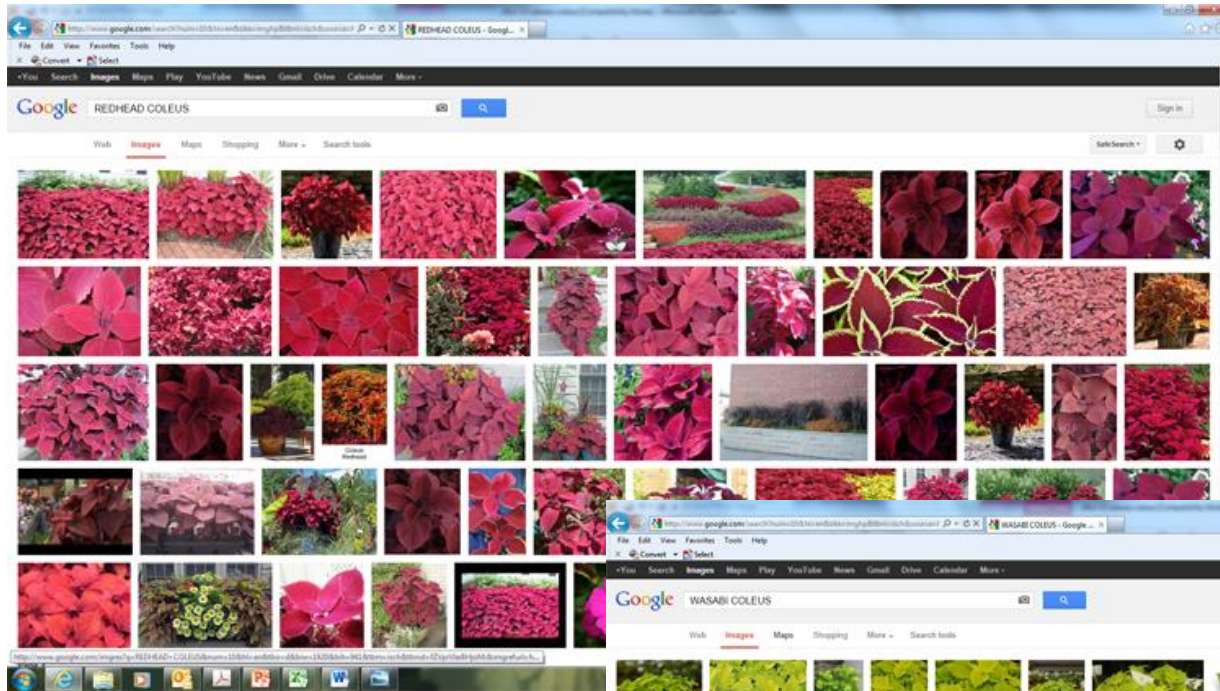
**Epcot**



**St. Louis**



# Coleus Intangibles





# UF Coleus

- **Continue to grab market share**
  - Tough, easy to grow plants
  - Now going global
- **Last year – 3.2M plants sold**
- **Royalties – most goes to the lab to pay students**



# OK, so what's NEW???





**Giving People What They Want:  
*Making New Plants That Look, Smell  
& Taste Better***



# Flowers Fruits & Vegetables



**Lots of choices**



# Flowers Fruits & Vegetables



**Lots of genetics**



# What do consumers experience?



**Sight  
Touch  
Smell**

**Sight  
Touch  
Smell  
Taste - memory**





# What do breeders experience?





# Who are the consumers?





# Who are the breeders?



# A SERIOUS Disconnect

- *Most flowers, fruits and vegetables are bought by women **and they influence the purchasing decisions on much of the rest***
- *Most plant breeders **and many industry decision makers** are men*





# A Problem...



# A BIG Question

- *How do we find out what consumers want?*
  - *Most people really don't know...*
  - *It is very hard to measure emotion*
  - *It is even harder to measure how much more people will pay if stimulated*



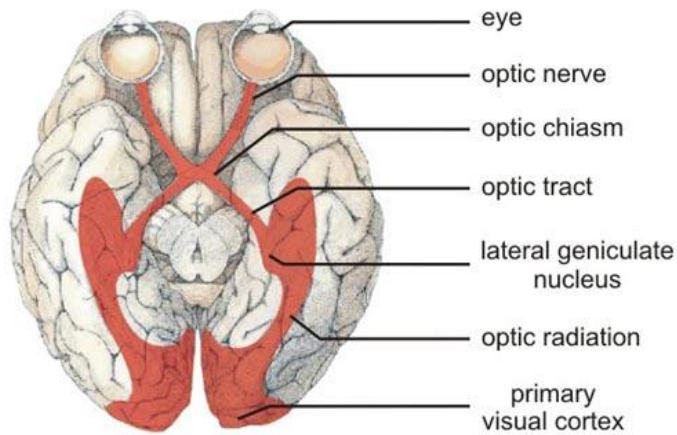


# Another BIG Question

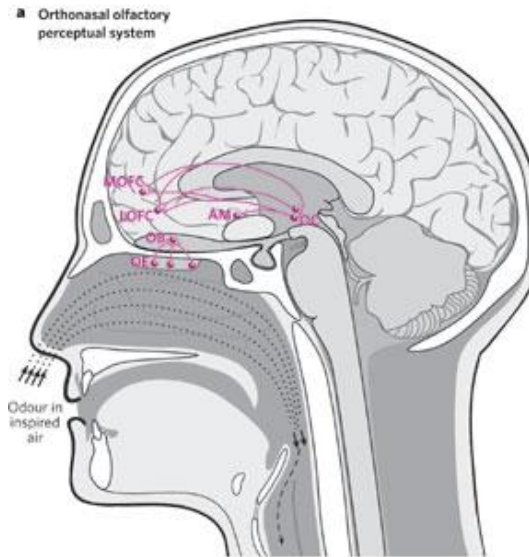
- *How do we decide goals for new crop development?*
  - *Usually based on yield characters (retrospect)*
  - *Easy to measure and predict*
  - *It is difficult to measure the pleasure and value of flavor and fragrance*



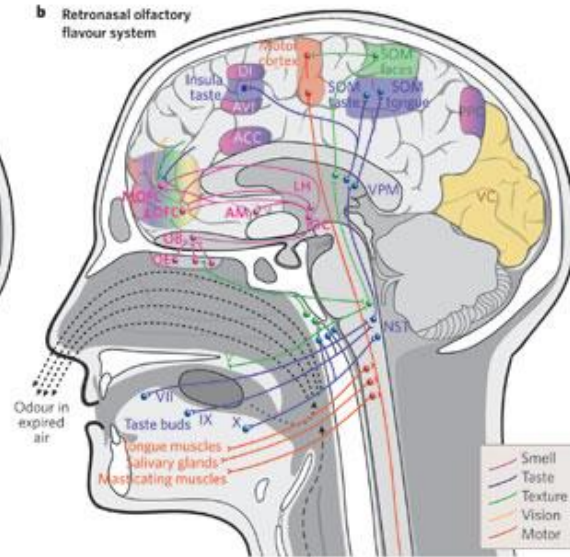
# To influence people, we should probably understand them...



**SIGHT**



**SMELL**



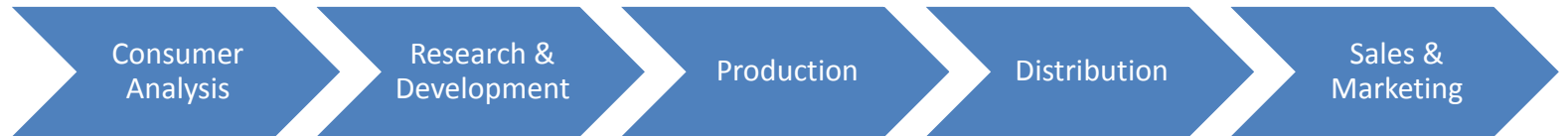
**TASTE**

*It's ALL in your mind...*



# Engaging the Complete Value Chain

## *Consumer Assisted Selection*



University of Florida



Consulting Partners

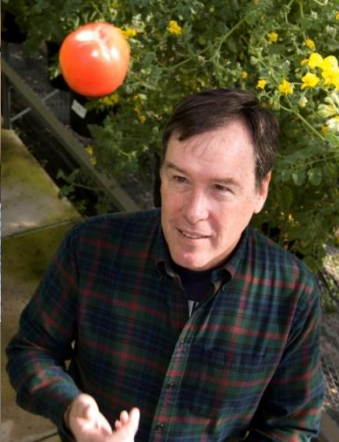


Industry Partners



***Find out what people want FIRST, then make the product***

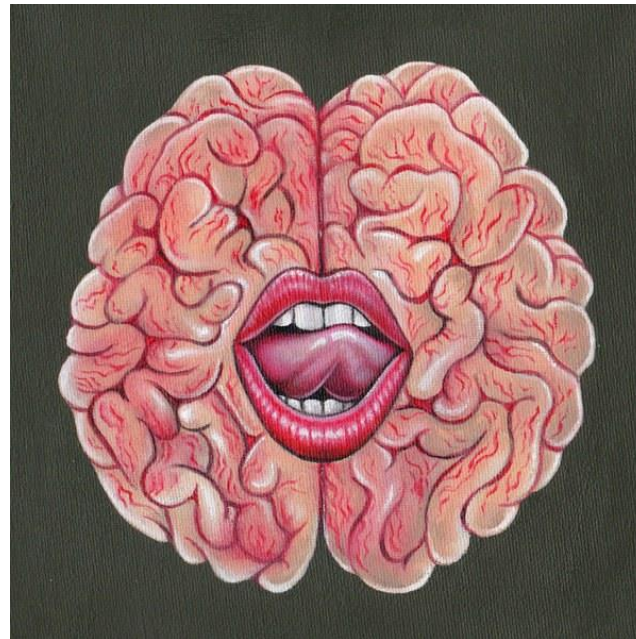
# Some VIPs





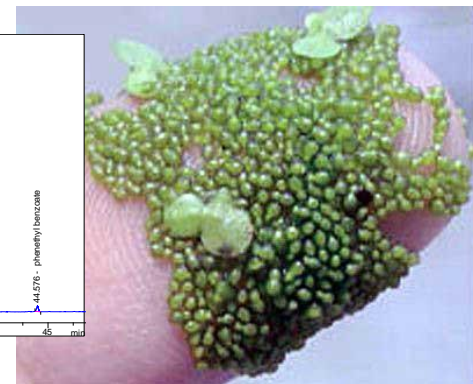
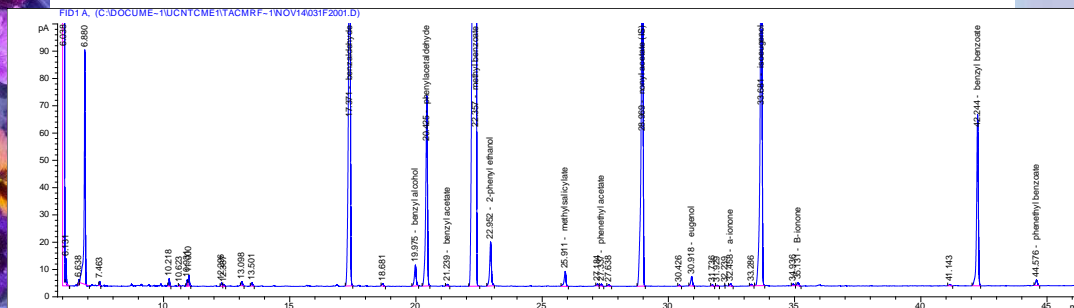
# Appealing to Consumers' Senses

- **Psychophysics** – quantifies the relationship between **physical stimuli** and the sensations and perceptions they effect (**behavior & emotions**)



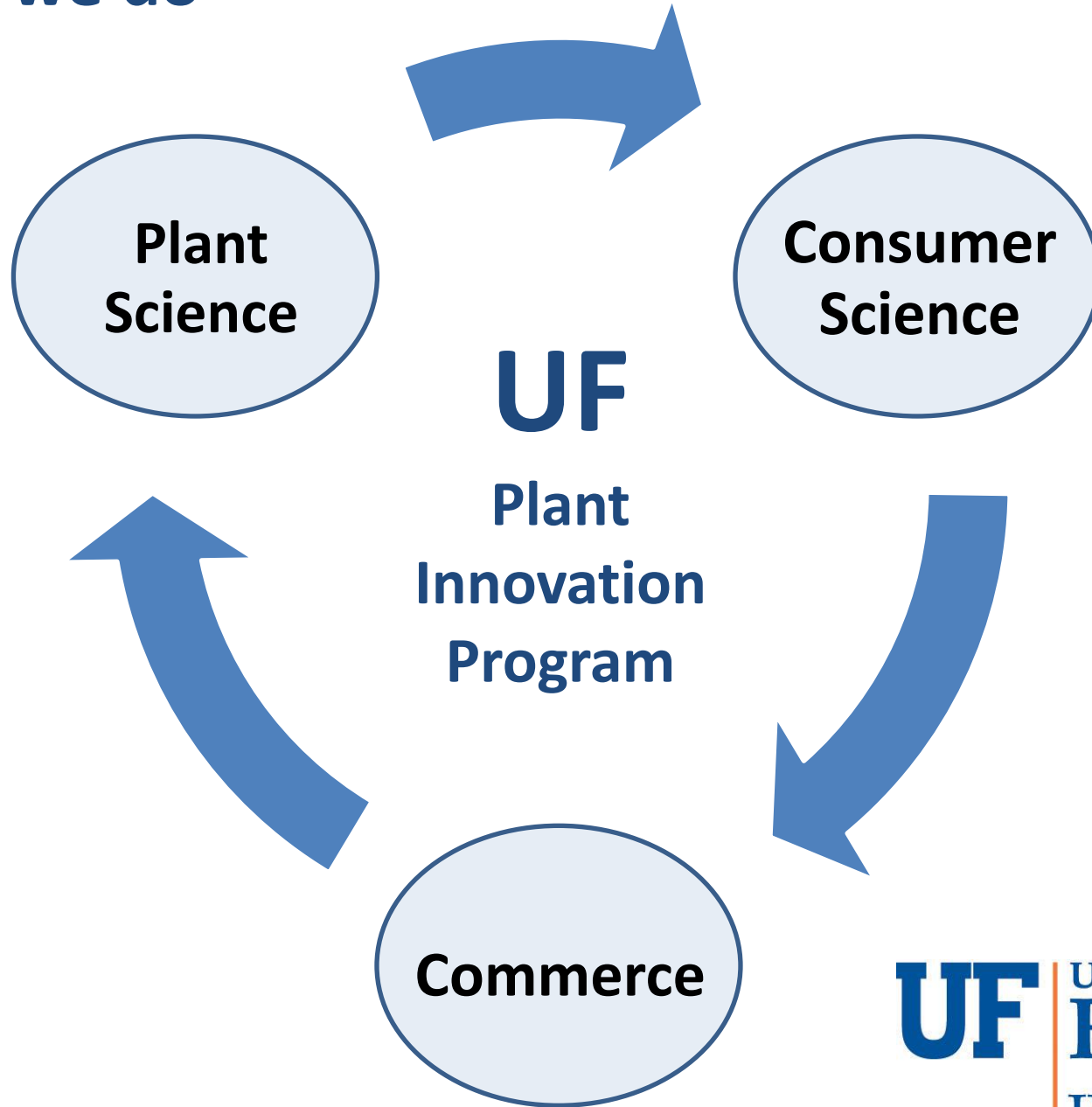
# Appealing to Consumers' Senses

- **Physical stimuli in plants** – controlled by genetic traits that are measured empirically
  - **Sight:** pigments (anthocyanins, carotenoids etc.)
  - **Taste & Smell:** sugars, acids, **volatiles**
  - **Feel:** physical features (trichomes, cuticles etc.)

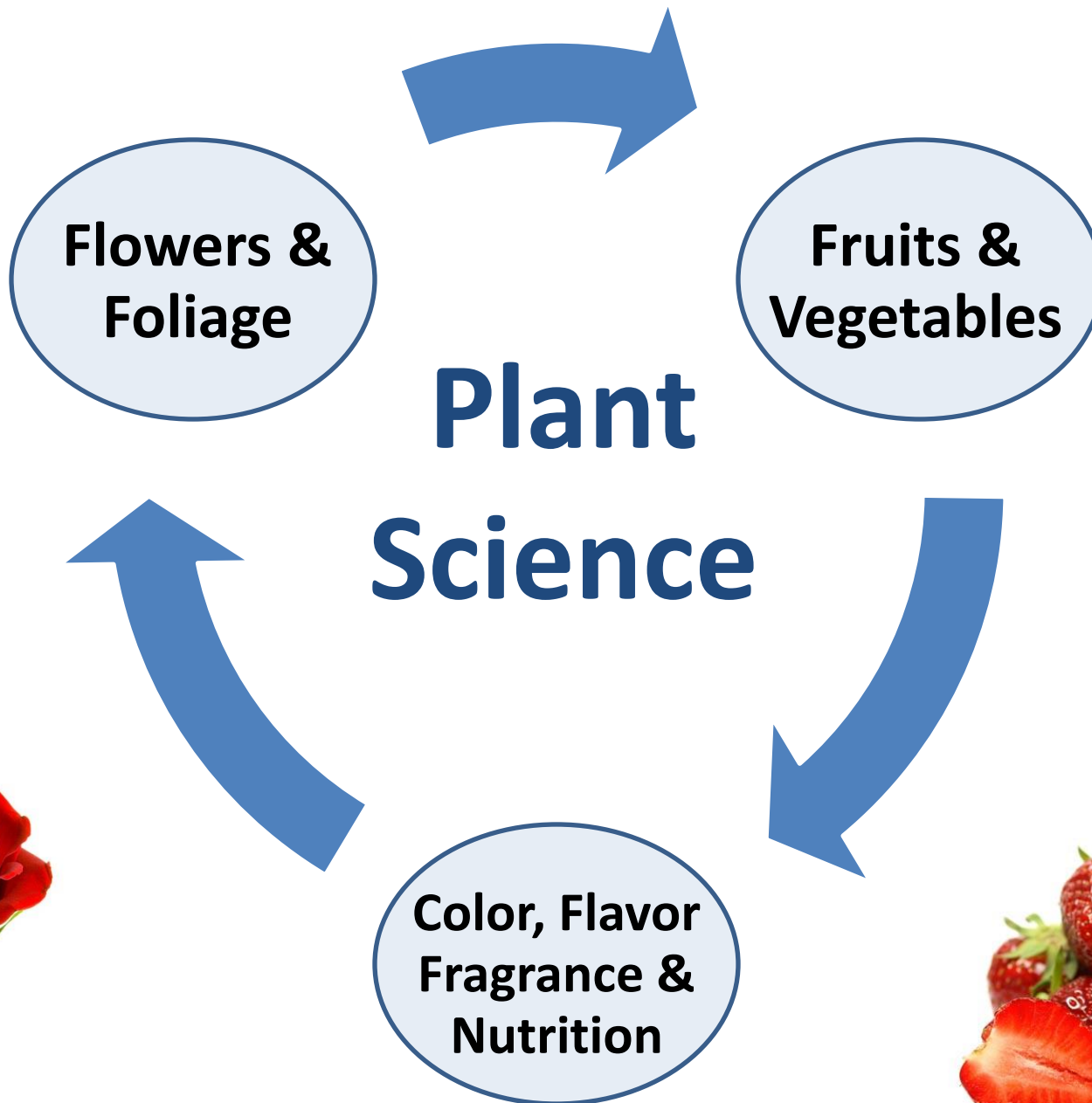




# What we do

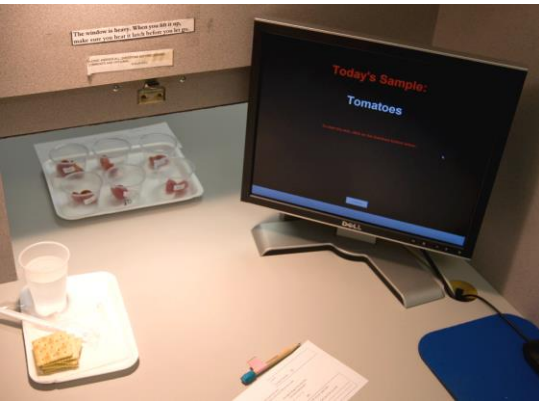
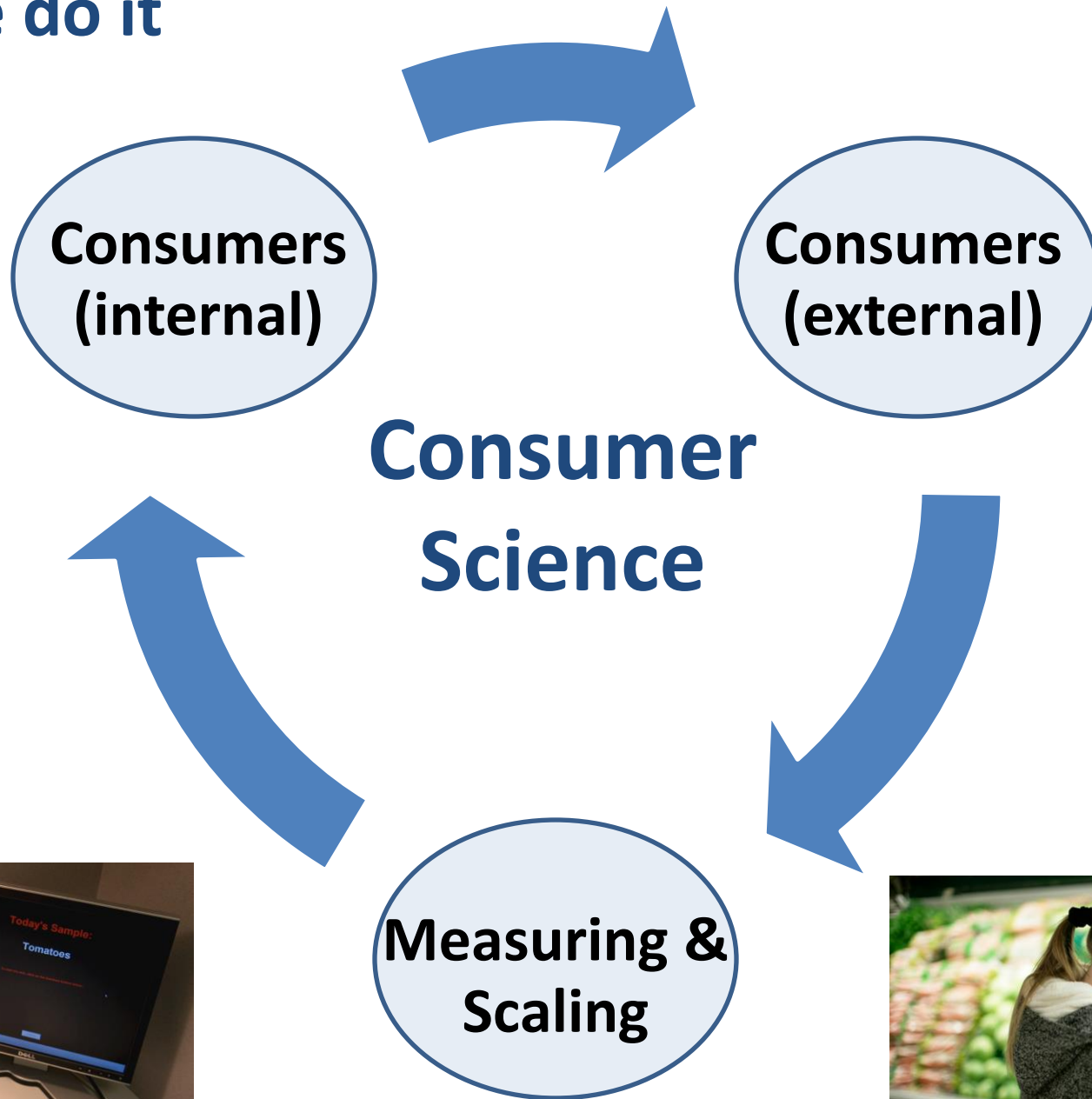


# How we do it

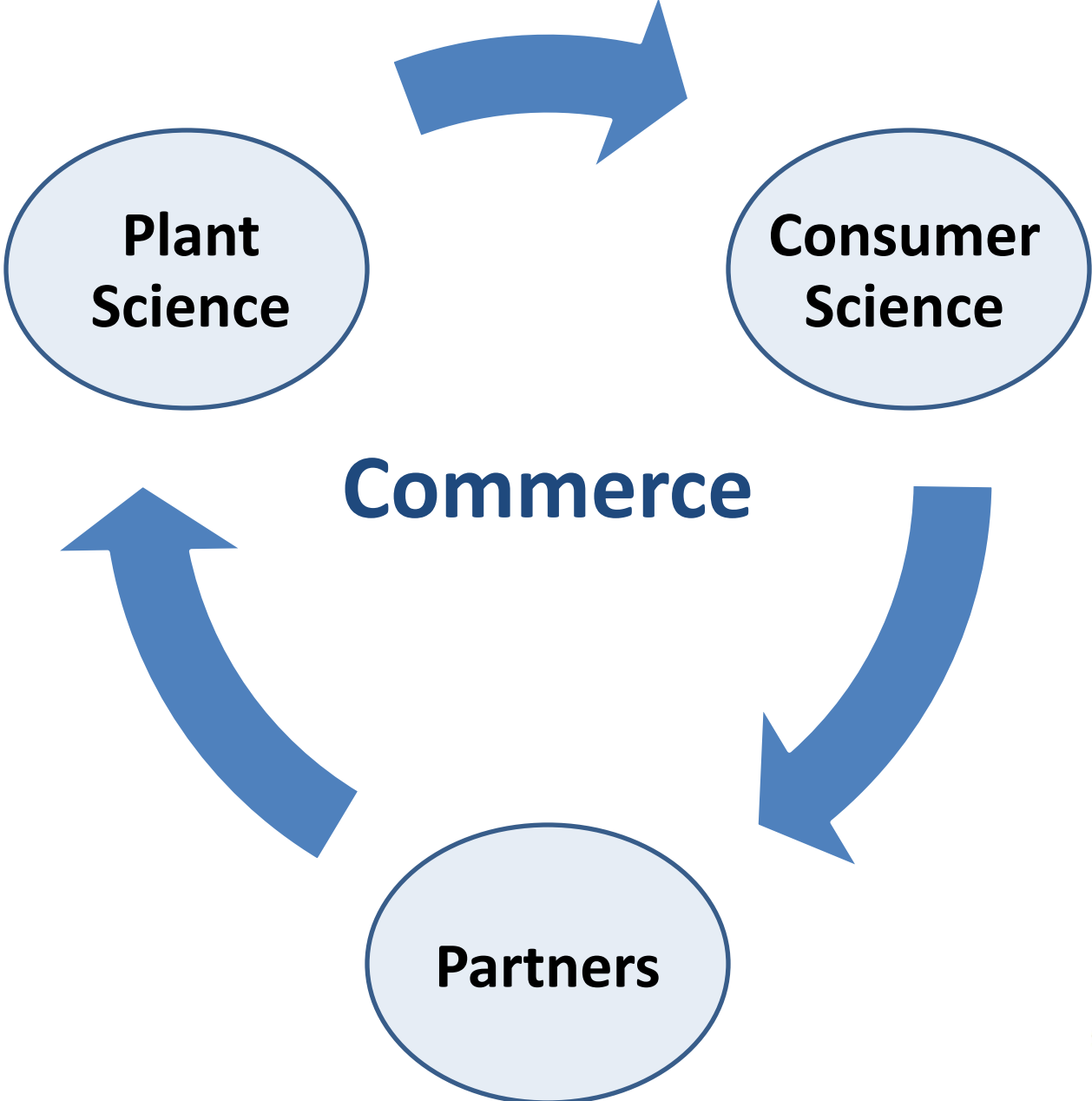




# How we do it



# Why this is important





# The landscape is changing...

"Mexico is not the problem. Florida has not evolved. They have become irrelevant in the marketplace. They've continued to supply tomatoes **the consumer doesn't want.**"

*Martin Ley, a spokesman for the Mexican growers, in an interview with the Tampa Bay Times.*

# Harry's tomato experiment – The recipe for a great tasting tomato

Tieman, Bliss, McIntyre, Blandon-Ubeda, Bies, Osabasi, Rodriguez, van der Knaap, Taylor, Goulet, Mageroy, Snyder, Colquhoun, Moskowitz, Clark, Sims, Bartoshuk & Klee (2012). *Current Biology*, 22, 1-5.



# Harry Klee – Tomato Volatiles



# Charlie Sims: Food Science

## Linda Bartoshuk: UF Center for Smell & Taste

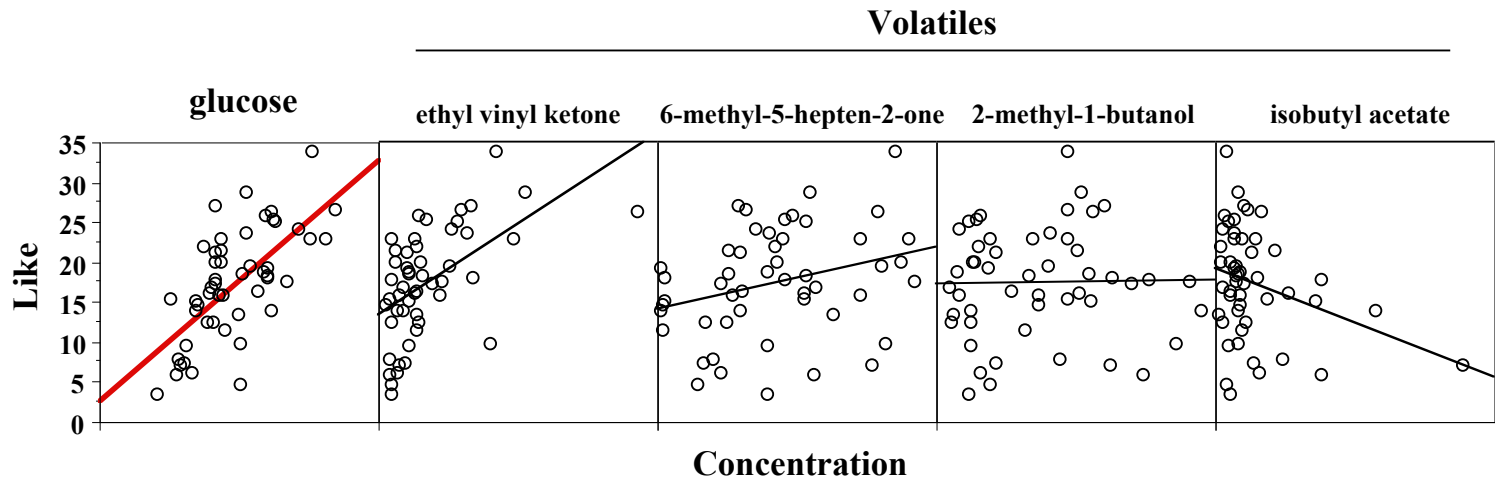




# Tomato Flavor Tests

- 79 heirloom tomato varieties tested
- 68 tomato flavor constituents measured in each variety
  - Sugars, acids, volatiles
- 170 subjects  
(not all subjects tasted all varieties)
  - Taste (e.g., sweet, salty, sour, bitter, umami)
  - Flavor
  - Palatability
- *Developed and validated statistical models to explain the chemistry of liking*





- Some volatiles correlated positively.
- Some correlated negatively.
- Some did not seem to matter.
- **“Recipe” for a better tomato:**
  - Pick the appropriate sugar level
  - Increase volatiles with positive correlations
  - Decrease volatiles with negative correlations

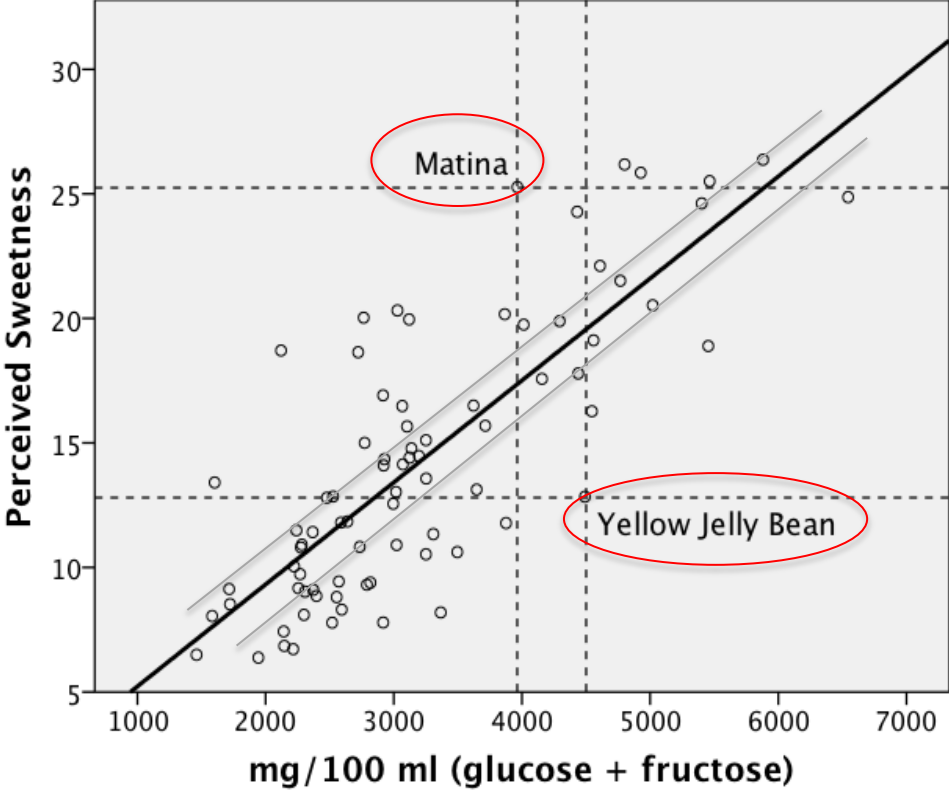


## A surprising discovery in the tomato data:

Multiple regression shows that the **volatiles in tomatoes make a significant contribution to sweetness independent of sugar.**

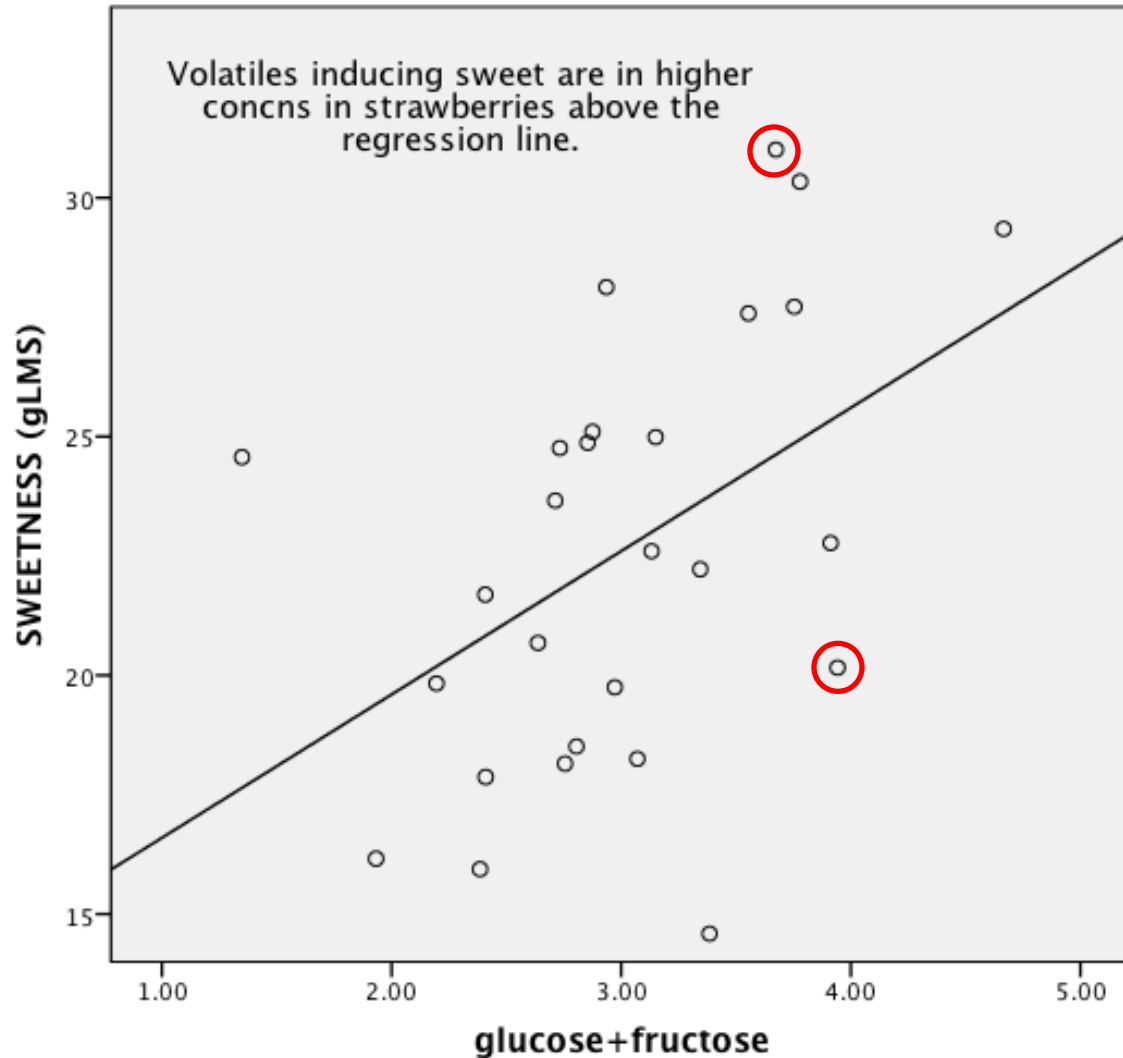


# Sweetness is much more than sugar in tomato





# Sweetness is much more than sugar in strawberry too...



# A new source of sweetness?

- Can we add the volatiles that induce sweet in citrus (and potentially other fruit) products to make them sweeter with less sugar?





# Consumer-assisted selection

- A great tasting “commercial” tomato is still a challenge. But...
- We’ve defined the target, identified many of the key genes and have started moving them into elite germplasm
- Our integrated “one-stop shopping” approach is applicable to any horticultural crop



# More VIP\$

- **USDA Floral & Nursery Initiative**
- **USDA Florida Block Grant**
- **American Floral Endowment**
- **National Foliage Foundation**
- **National Institutes of Health**
- **The Coca-Cola Company**
- **University of Florida Research Foundation**
- **Florida Agricultural Experiment Station**
- **Florida Foundation Seed Producers**





# My lab – 2013 – Go Gators!



PLANT



INNOVATION

PROGRAM