

TOMATO INNOVATION

Breeding & Trialing
for Your Finest Harvest



Today's presenters



Sihui "Olivia" Gao



Daniel Yoder

An aerial photograph of a large agricultural research farm. The scene includes several long, covered walkways (likely for seed production), various farm buildings, a pond, and rows of crops. A prominent green rounded rectangle is overlaid in the center, containing the text 'Johnny's Research Farm' in white serif font. In the background, there are dense green forests and rolling hills under a clear sky. In the foreground, a blue tractor and other farm equipment are visible near one of the covered walkways.

Johnny's Research Farm

JOHNNY'S RESEARCH FARM

Located in Albion, Maine (zone 5b)

200 acres over 11 isolated fields managed with an emphasis on soil health:

- Wide spacing to facilitate rotations
- Approximately 50% in cover crops annually
- Organic growing techniques and inputs

Teams & Activities:

- Farm Operations & Maintenance
- Greenhouse Operations
- Product Development
- Seed Productions
- Breeding





Johnny's 2023 Farm, Maintenance, & Greenhouse Teams

Copyright © 2024 Johnny's Selected Seeds. All rights reserved.

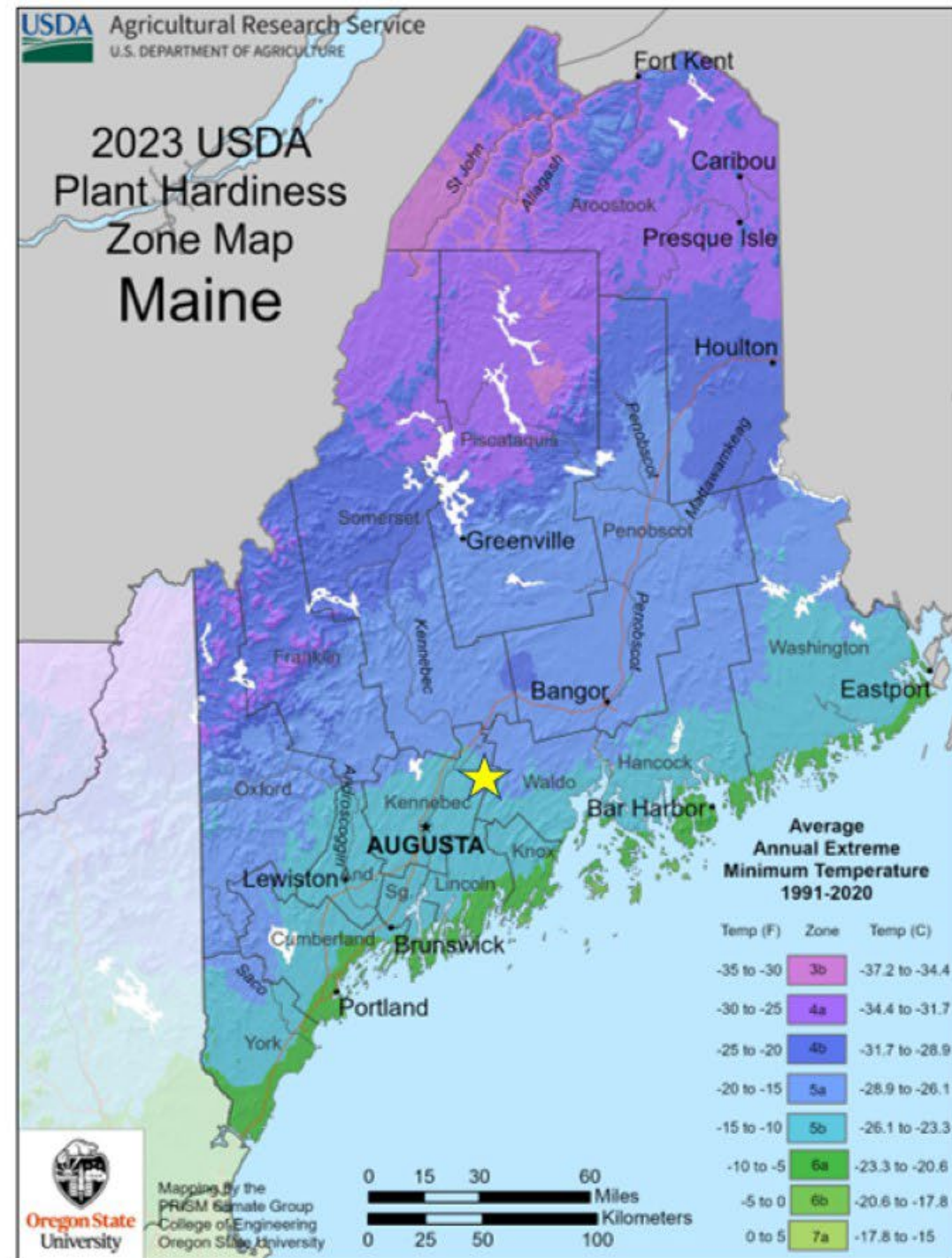
Johnny's Home Farm

- 11 separate fields
- Diverse soils and land
- Short season, long days
- Hot & humid but cool nights

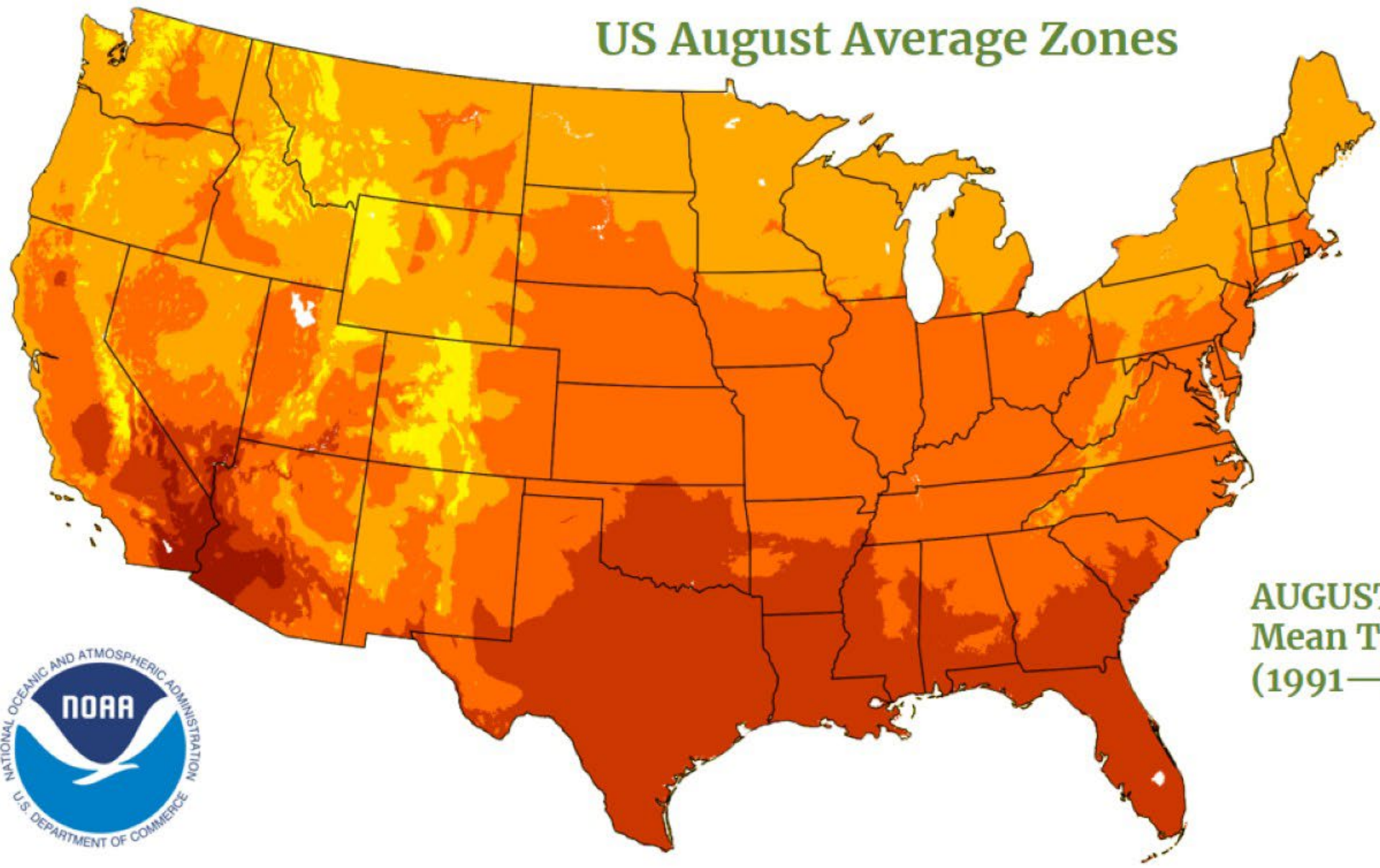
Johnny's Regional Trials

- Hardiness zone
- Planting dates (day length)
- Humidity/rainfall/sunlight
- Soil types
- Pest pressures
- Management practices
- Market needs

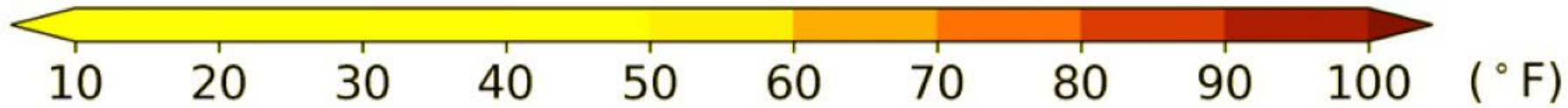
Image source: <https://planthardiness.ars.usda.gov/>



US August Average Zones



AUGUST
Mean Temperature Normal
(1991—2020)



US Annual Rainfall

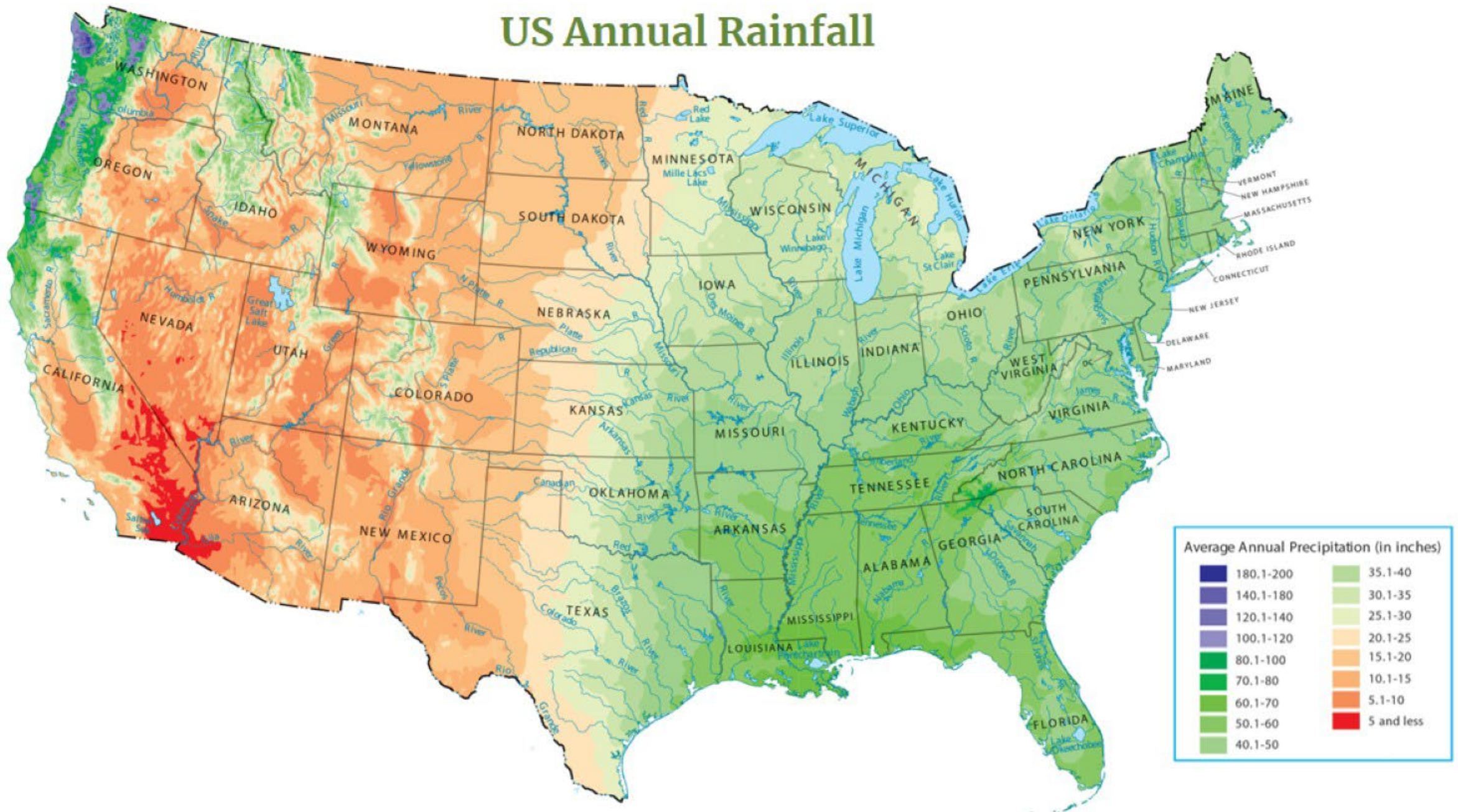
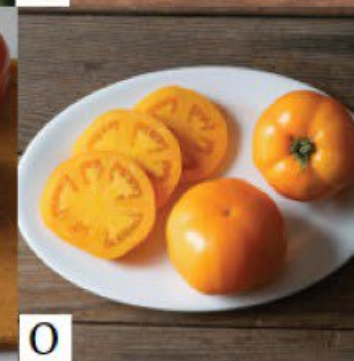
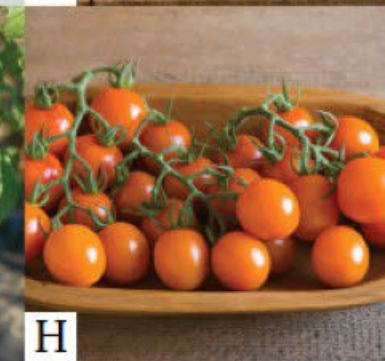
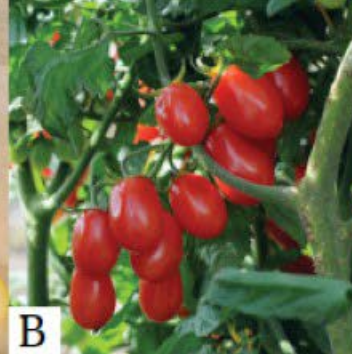


Image source: <https://gisgeography.com/us-precipitation-map/>

JOHNNY'S CLASSICAL TOMATO BREEDING PROGRAM

- | | |
|--------------------------------|-----------------------------------|
| A. Taxi
(1986) | I. Cherry Bomb
(2016) |
| B. Red Pearl
(2010) | J. Valentine
(2018) |
| C. Five Star Grape
(2011) | K. Citrine
(2020) |
| D. Martha Washington
(2012) | L. Abigail
(2021) |
| E. Defiant PhR
(2012) | M. Harvest Moon
(2024) |
| F. Verona
(2013) | N. Strawberry
Fields
(2024) |
| G. Jasper
(2013) | O. Marmalade
Skies
(2024) |
| H. Clementine
(2015) | |



TOMATO BREEDING GOALS

- Excellent flavor & eating quality
- Reliability
- Early maturity
- Wide adaptation
- Direct market appeal
- Labor saving
- Disease resistance
 - Late blight
 - Early blight
 - Septoria leaf spot
 - Leaf mold



HIGH TUNNEL ADAPTATION



Breeding High Tunnel at Johnny's Research Farm



DISEASE RESISTANCE



TOMATO TRAITS OVERVIEW

PLANT

Vigor (height & canopy)
Tidiness (compact vs. wild)
Habit (vegetative vs. generative)
Health (ID diseases)

YIELD

Maturity & Duration
Pollination/Fruit set
Yield Potential
Marketability (defects)

FRUIT

Flavor & Texture
Truss & Calyx Traits
Size, Shape
Shelf-life, Firmness

OTHER

Genetic Resistances
Seed Quality
Seed Form
Price



OPEN FIELD TRIAL DESIGN

Prepare for Field Planting

- 200-300 varieties
- Treat Seed
- Tricky Germination
- Bump up transplants into 72's

Field Layout

- Living mulches before and during crop
- Plasticulture, drip tape
- Basket weave w/ walking breaks
- 12' centers, 2' in-row
- Multiple check plots



SEEDLING PHASE



ESTABLISHMENT



FIRST HARVEST



September 3 – Determinate Paste Tomato

**Indeterminant
Plants**

**Determinant
Plants**



Early Sept Frost – 2020

Photo: 9/21/20



SUMMARY

Selecting an Open Field Tomato

- Canopy coverage (south)
- Tolerance to the elements & disease
- High output over shorter duration
- Eating quality



HIGH TUNNEL TRIAL DESIGN

- Bump up into 4" pots (sometimes)
- Indeterminates on vertical string, single-leader
- Determinates on basket weave, prune to 1st branch
- Drip irrigate 2x daily, fertigation
- Foliar spray as needed, bio-controls



ESTABLISHMENT



First Flowering Stage



POLLINATION

- Wind and Insect pollinated
- Self-fertile
- Temperature – optimal range
 - Blossom Drop – stress response
 - Below 55° or 50°F
 - Over 90° F days, high nights >75° F
 - Drought stress
- Healthy flowers and plants
- Genetic differences in the flower

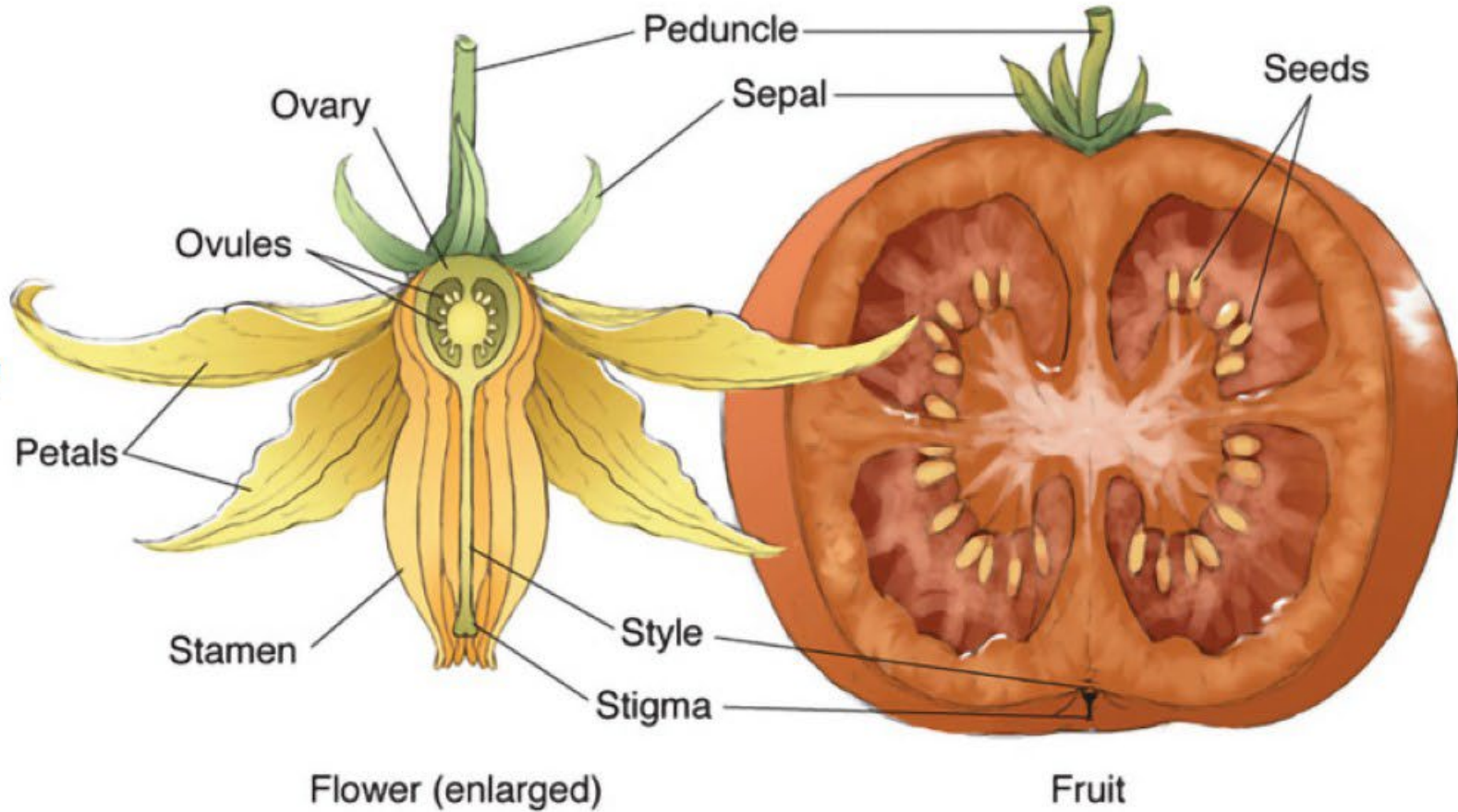


Image source:

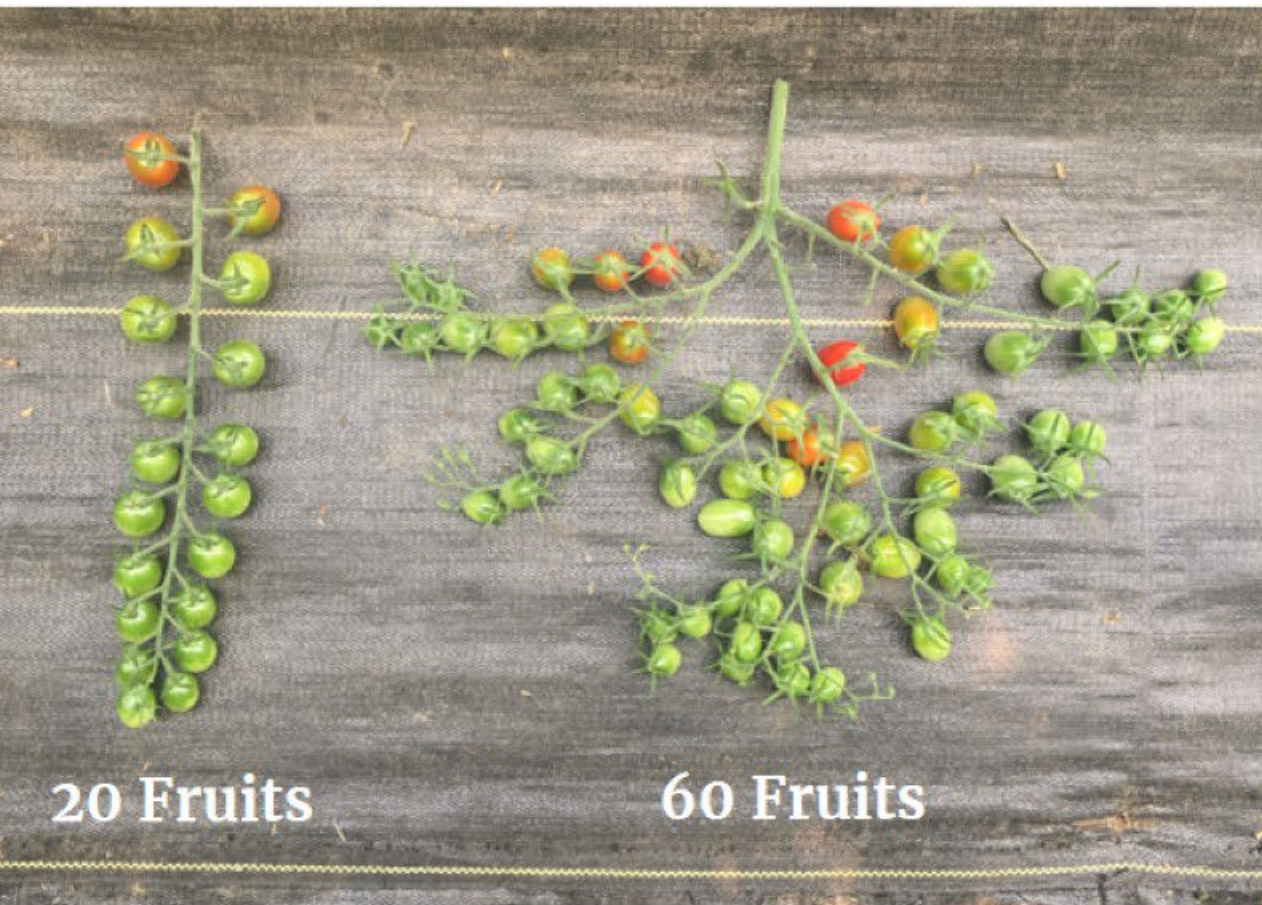
<https://www.buncombemastergardener.org/flicking-tomato-flower-tomato-fertilization/>

POLLINATION = FRUIT SET



TRUSS STRUCTURE

Single Stem vs. Branching





Yield Harvest Process

- Weekly Harvest
- Size, Color, Uniformity
- Weight, Marketability
- Eating Qualities
- Changes throughout season

Unmarketable = Plant's Fault

- Cracking/Splitting/Concentric Rings
- Catfacing/Zippering/Scarring
- Oversized Blossom or Stem Scars
- Undersized (racquet ball) or Mishappen
- Uneven Ripening/Yellow Shoulder/Greywall
- Hollowness
- Sun Scald

Shelf Life

- Critical for high value production
- Profits and flexibility
- Sugars, water, density, skins, etc
- 7-10 days at room temperature



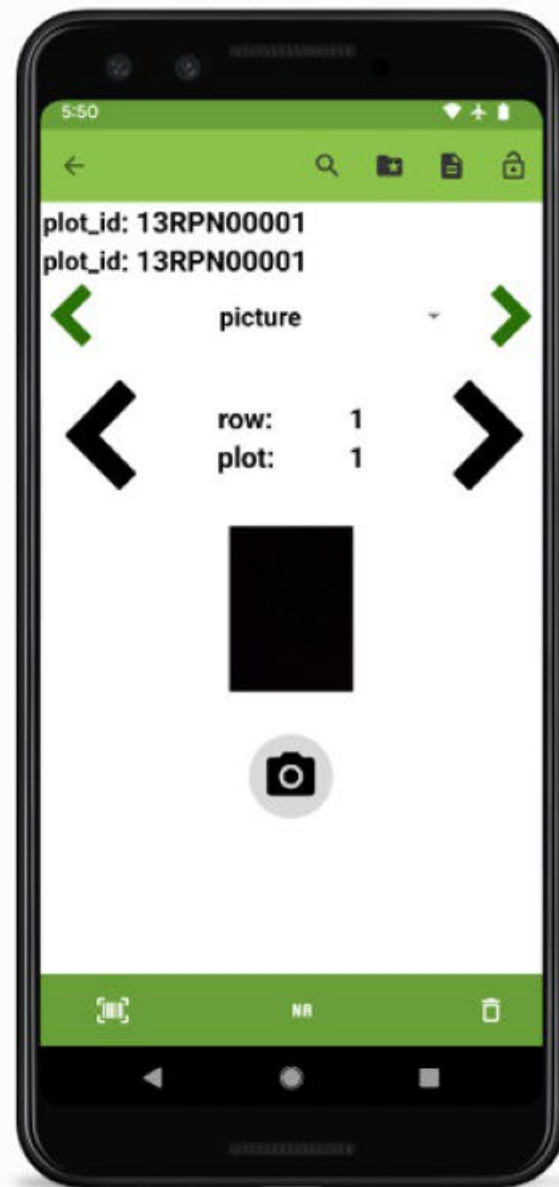
SUMMARY

Selecting a High Tunnel Tomato

- Compact internodes and tidy truss of ideal size
- Production over longer cycle
- Balanced vigor with earliness
- Consistency in plant and fruit
- Fruit Set in high temperatures & low pollination
- Tolerance to indoor disease pests



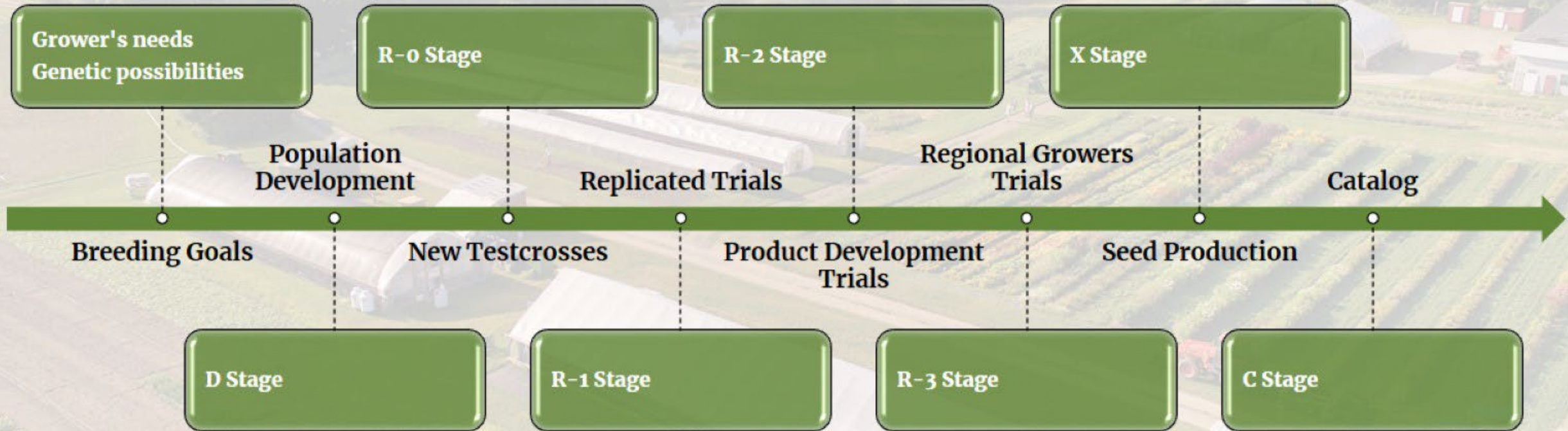
COLLECTING DATA



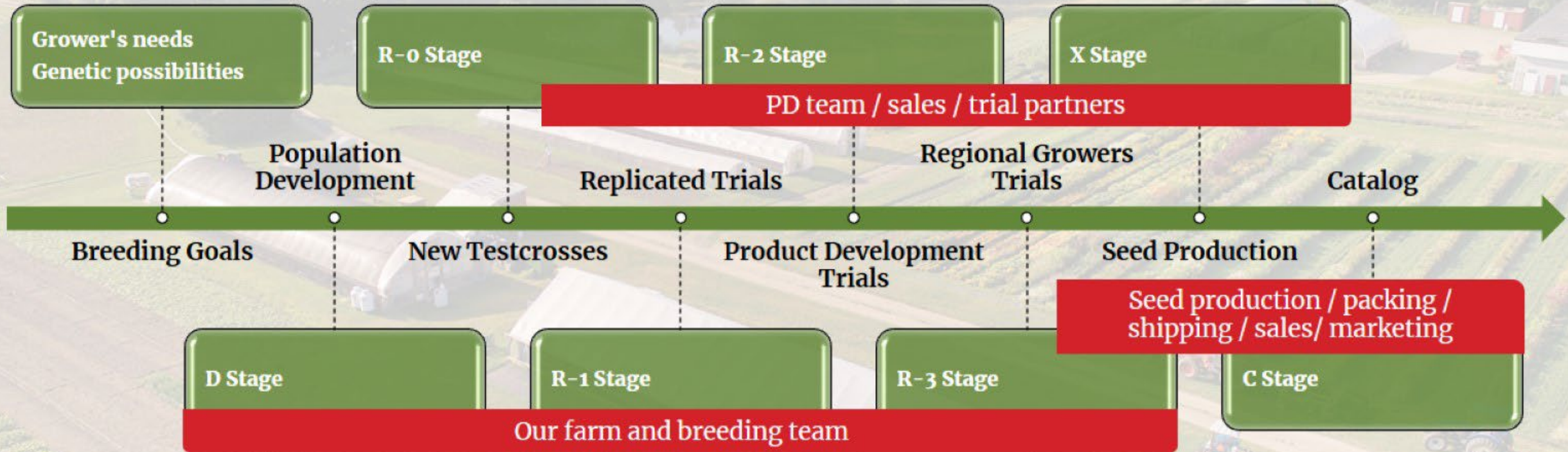
Fieldbook
by
PHENOAPPS

<https://docs.fieldbook.phenoapps.org/en/latest/field-book.html>

CURRENT BREEDING PROGRAM



CURRENT BREEDING PROGRAM



CROSS POLLINATION



SEED PRODUCTION

Breeder
Seed

Foundation
Seed

Stock
Seed

Commercial
Seed



NEW

Marmalade Skies

Marmalade Skies

Habit

Vegetative, Tall

Maturity

Medium Early

Fruit

Tall Beef, 8-10 oz

Color

Solid Orange

Main Use

Open Field

Resistance

LB

Valencia

Habit

Mildly Vegetative, Slightly Compact

Maturity

Medium Early

Fruit

Lightly Ribbed Slicer, 8-10 oz

Color

Solid Orange

Main Use

Open Field

Resistance

None Known



NEW

Marmalade Skies



NEW

Strawberry Fields

Strawberry Fields

Habit

Balanced

Maturity

Medium Early

Fruit

Lightly Ribbed Slicer, 7-10 oz

Eating

Acidic & Sweet, Slightly Firmer

Main Use

Open Field/Tunnel

Resistance

LB, RKN

Abigail

Habit

Mildly Generative

Maturity

Early

Fruit

Flattened Beef, 10-16 oz

Eating

Mildly Sweet and Delicate

Main Use

Open Field

Resistance

LB



NEW

Strawberry Fields



JTO-1168



NEW

Strawberry Fields



NEW

Harvest Moon

Harvest Moon

Habit

Mildly Generative, Compact

Maturity

Early

Fruit

Slightly Flattened, 7-10 oz

Color

Golden Bicolor

Main Use

Open Field

Resistance

LB

Margold

Habit

Mildly Generative

Maturity

Medium

Fruit

Slightly Tall, 7-10 oz

Color

Yellow Bicolor

Main Use

Tunnel/Greenhouse

Resistance

LM/ToMV/V



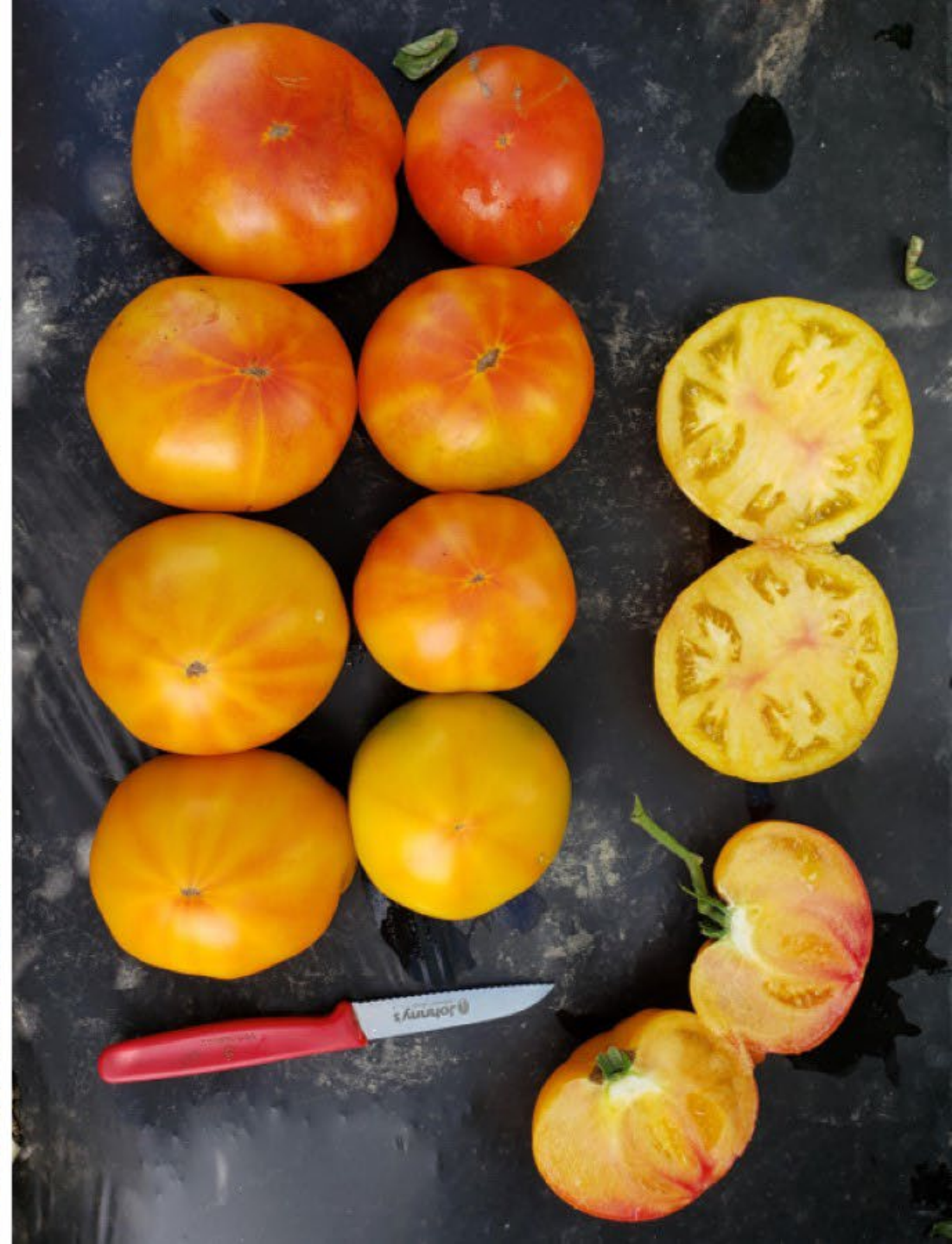
NEW

Harvest Moon



NEW

Harvest Moon





THANK YOU

We hope you enjoyed this presentation!

Johnnyseeds.com/webinars

