

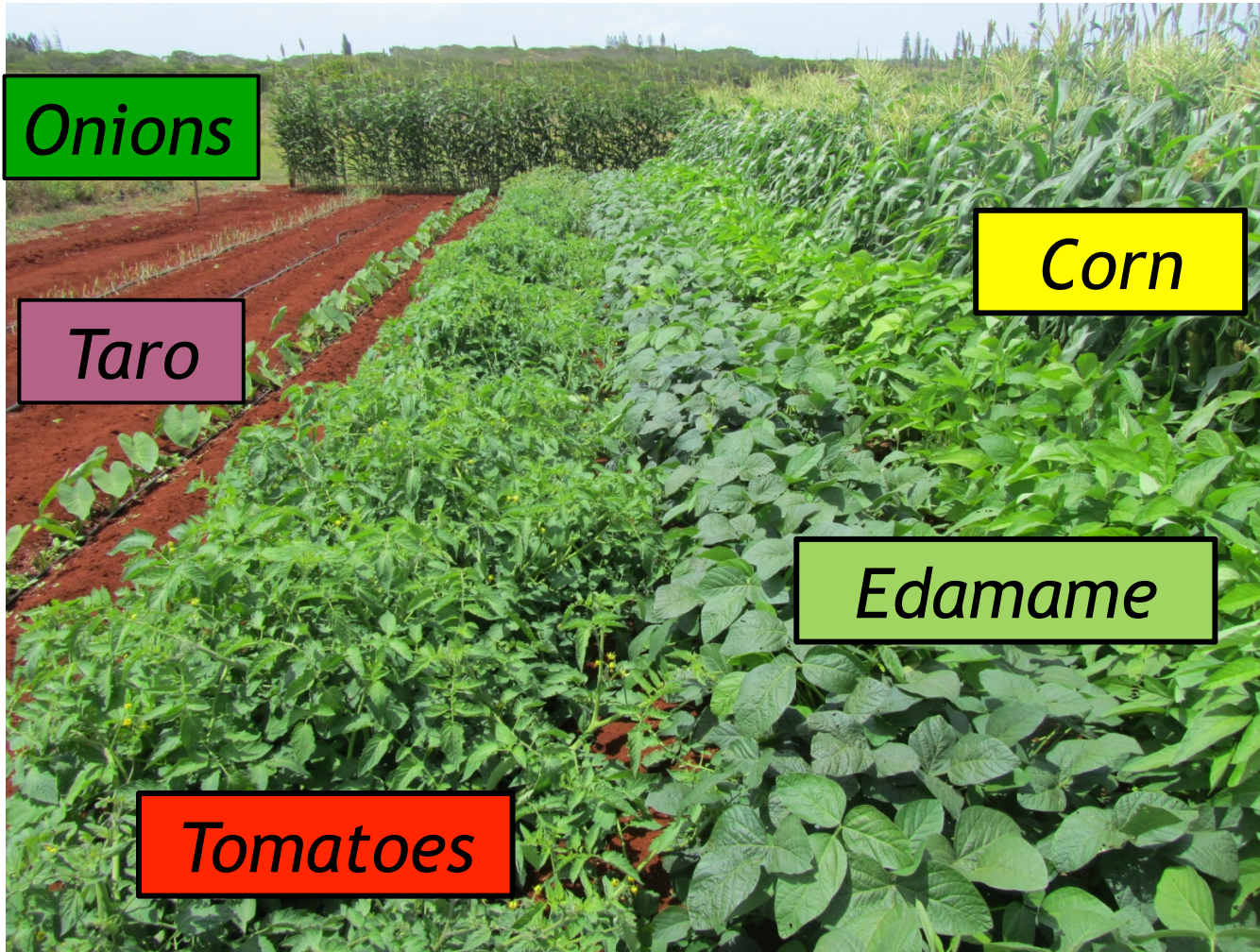
# SELECTING TOMATOES FOR THE HAWAIIAN GARDEN

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# AN ESSENTIAL HAWAIIAN GARDEN VEGETABLE





# VEGETABLES FROM THE GARDEN



# TOMATO'S ROLE IN THE CIRCLE OF LIFE

- ◉ Second most consumed vegetable behind its cousin, the potato.
- ◉ Essential element in salads, the red in the greens.
- ◉ Important in sauces, stews, pasta, and ketchup.
- ◉ Under intensive production, tomatoes can yield >100,000 lbs/A



## THOUGHT FOR THE DAY

*“The ultimate goal of farming is not the growing of crops, but the cultivation and perfection of human beings.”*

**Masanobu Fukuoka**  
*One Straw Revolution*

Why  
Save  
Seeds?



## ELIOT COLEMAN QUOTE #1

***“Seeds are the spark of the farm operation, and the more control the grower can exert, the more dependable the system will be”***

## ELIOT COLEMAN QUOTE #2

***“For most crops, the vigor and viability of seed grown under careful cultural practices of this production system will far excel seeds that are purchased.”***



## ELIOT COLEMAN QUOTE #3

***“I doubt that the direction of present-day seed breeding, selection, and genetic manipulation is favorable to the producer of high quality vegetables ...”***

## PUTTING IT ALL TOGETHER ...

Grow your own seed:

- ⦿ For better control of your garden or farm.
- ⦿ For better seed quality and vigor.
- ⦿ For your specific environment and needs because no one else will grow them for you.
- ⦿ To cultivate and perfect yourself



# ORIGINS

- ◉ Tomato, *Lycopersicon esculentum* is native to the tropical Americas, from Mexico to Chile.
- ◉ Dozens of wild *Lycopersicon* species occupying many environmental niches, from the mountain to the shore
- ◉ Important in transferring genes for fruit quality, pest and disease resistance, and environmental adaptability into the modern tomato.

# PLANT TYPES

- ◉ Determinate (bush) - concentrated harvest, short harvesting period. Field production. Ground culture. More wind resistant.
- ◉ Indeterminate (trellis) - Greenhouse; harvest over long period. High yields, high labor. Usually pruned to a single stem. Susceptible to wind. Can be grown on the ground but unwieldy.

# DETERMINATE (BUSH) GRAPE TOMATOES SUGARY & ARIA





# INDETERMINATE TOMATO LOVE SONG





# PEST RESISTANCE

- ◉ Tomato has the genetic potential to create a cultivar with resistance to most of the diseases of a specific locale, although some are problematic and difficult to control. i.e. Late blight.
- ◉ Man's bad farming habits create ideal conditions for some diseases. i.e. no crop rotation, incremental plantings, lack of crop-free periods. Imposing a crop-free period is one strategy to keep a disease at low levels. i.e. Spotted wilt virus

# BASIS OF RESISTANCE

Wild Lycopersicon species:

- ◉ L. peruvianum - early blight, leaf mold, fusarium wilt, septoria leaf spot, nematodes
- ◉ L. hirsutum - early blight, bacterial speck, root-knot nematodes, natural insecticide, hairs create physical barrier for mites
- ◉ L. pimpinellifolium (currant)- bacterial wilt, fusarium wilt
- ◉ L. cerasiforme - short stigma = less out-crossing, more true-to-type, heat tolerant
- ◉ L. cheesemanii - heat & salt tolerance, high vitamin C, jointless pedicels,

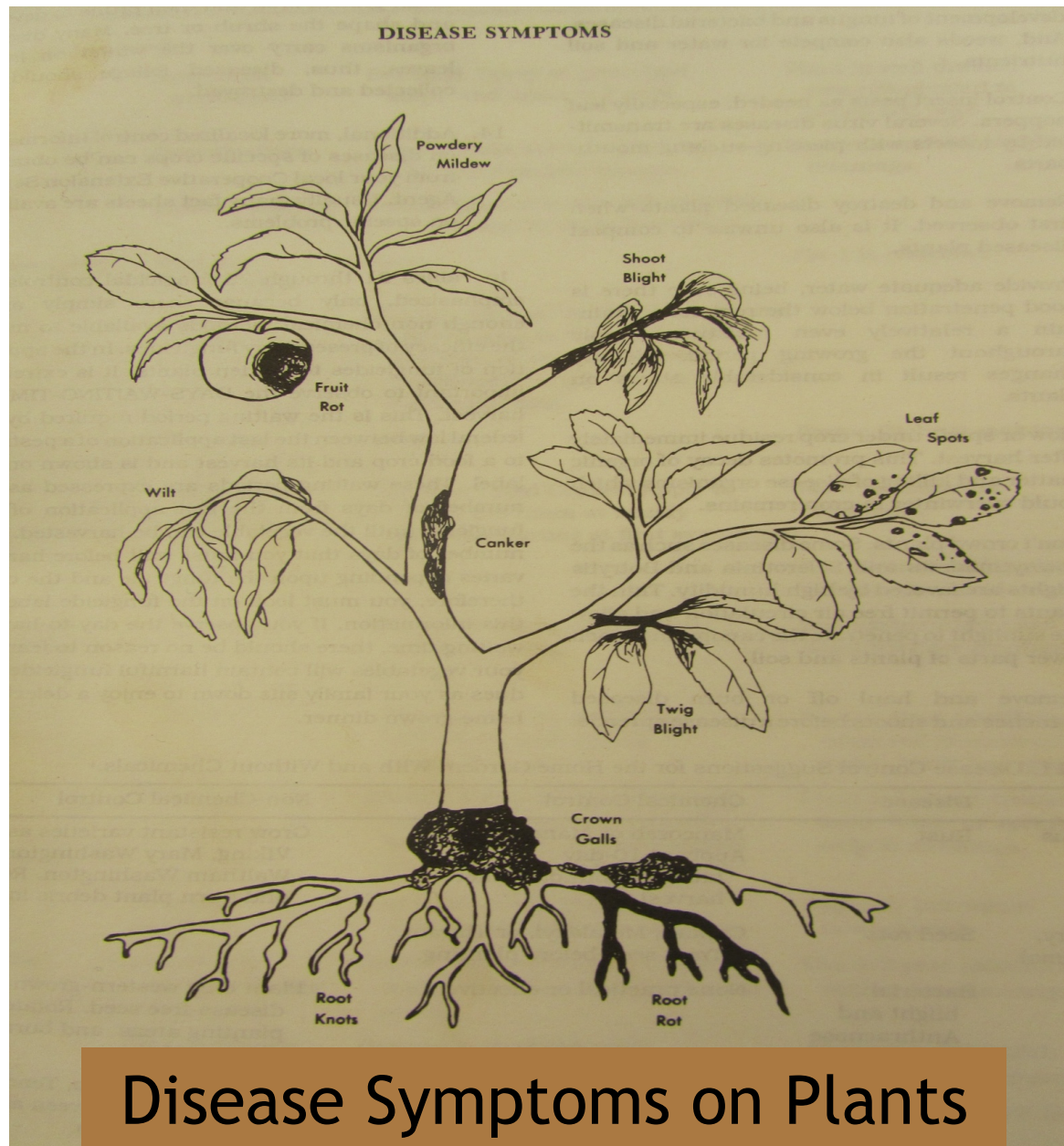
# NEW DISEASE-RESISTANT LINES



## BASIS OF SELECTION

Each seedling is an individual with the potential to possess genes unique from its siblings. Genes will be expressed under certain conditions. i.e. heat stress, low input, disease pressures, heavy rains, high clay soil, low day & night temperature differential, high humidity, etc.



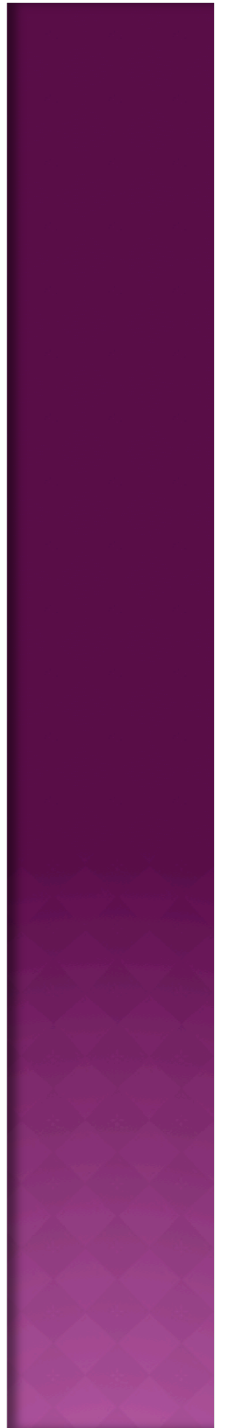




# DISEASES OF TOMATO IN HAWAII

- ◉ Tomato Yellow Leaf Curl Virus - NEW
- ◉ Pepper Mottle Virus - old, but recently ID'd
- ◉ Tomato Spotted Wilt Virus
- ◉ Tobacco Mosaic Virus
- ◉ Early Blight & Stem Canker - Alternaria
- ◉ Late Blight - Phytophthora
- ◉ Leaf Mold - Fulvia
- ◉ Stemphylium - Grey Leaf Spot
- ◉ Fusarium & Verticillium Wilt
- ◉ Root-Knot Nematodes
- ◉ And many more...

# TOMATO YELLOW LEAF CURL VIRUS



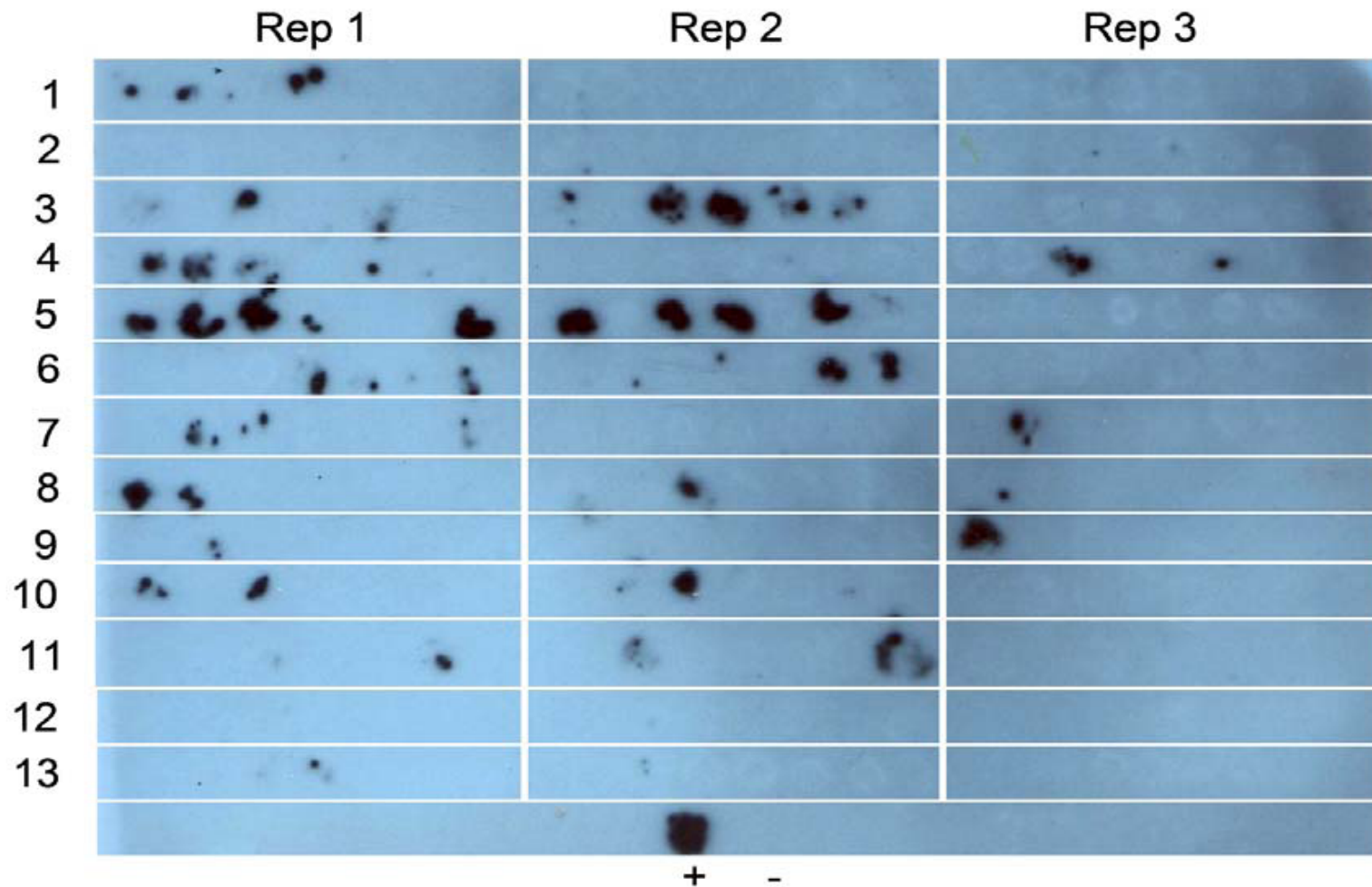
# TOMATO TSWV/TYLCV RESISTANCE TRIAL

## UH CTAHR POAMOHO EXP STAT. - OCT 2011

MELZER, SUGANO, FUKUDA, RADOVICH, UYEDA, TEVES, MIGITA

| #  | Variety      | Source        | Fruit        |
|----|--------------|---------------|--------------|
| 1  | VT-60783     | Zeraim Gedera | Globe        |
| 2  | <b>72767</b> | <b>Nirit</b>  | <b>Grape</b> |
| 3  | 8466         | Nirit         | Roma         |
| 4  | Felicity     | Hazera        | Cherry       |
| 5  | Olivia       | Hazera        | Grape        |
| 6  | Ofri         | Hazera        | Globe        |
| 7  | 72835        | Nirit         | Baby Roma    |
| 8  | 72061        | Nirit         | Globe        |
| 9  | 72205        | Nirit         | Globe        |
| 10 | Tymothy      | Hazera        | Cherry       |
| 11 | VT-60773     | Zeraim Gedera | Globe        |
| 12 | <b>7105</b>  | <b>Nirit</b>  | <b>Globe</b> |
| 13 | HA-46204     | Hazera        | Baby Roma    |

# TYLCV VIRUS RESISTANCE TISSUE BLOT TEST





Nirit  
72835





# CONVENTIONAL BREEDING CONSIDERATIONS

## Fruit Quality Evaluation:

Shape

Color

Shoulder color

Core size

Taste

Blossom end

Firmness

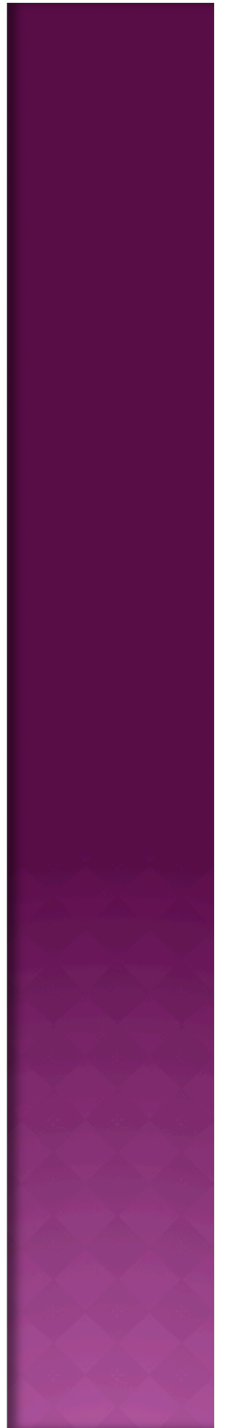
Shoulder shape

Gel color

Wall thickness

Pedicel type

Stem end



# GREEN SHOULDERS



# Fruit Cluster Types





# BRANCHING CLUSTERS



# BREEDING CONSIDERATIONS

Free from the following defects:

- ◉Cracking - concentric & radial
- ◉Cat-facing
- ◉Puffiness
- ◉Sun scald
- ◉Blossom-end rot
- ◉Zipper fruits
- ◉Nipple tips



# BREEDING CONSIDERATIONS

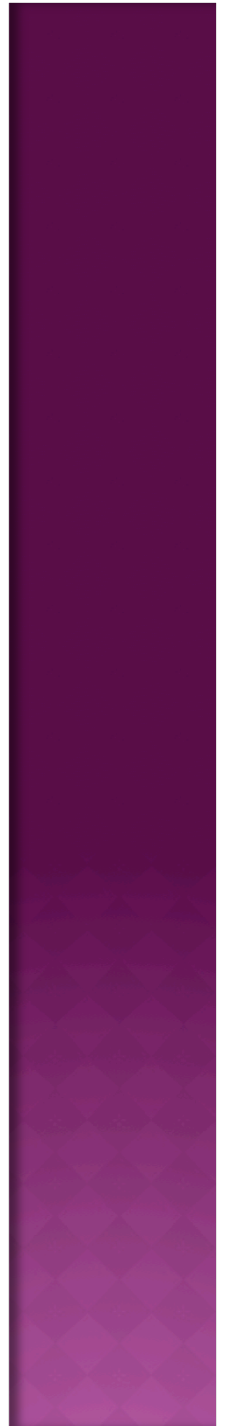
- Plant: canopy (sun scald), habit (determinate and indeterminate), internode spacing, size
- Disease Resistance: fungus, bacteria, virus, physiological
- Other: nutrition, pesticide-free, organic vs. conventional

# REGIONAL BREEDING

## Southern Tomato Exchange Program (STEP)

- ◉ Each state bred for their own problems
- ◉ Accessions from other states included as part of side-by-side tests. Crossing with accessions from other states to develop a well-rounded tomato from unrelated lines. i.e. Crossing a disease-resistant line with a high fruit quality line.
- ◉ STEP ended in the 1990's.
- ◉ Few active breeding programs left - Florida, North Carolina, Oregon, Penn State, Ohio State, Michigan State, UC Davis, Cornell, others.

‘INDIGO ROSE’  
JIM MYERS - OREGON STATE



# BREEDING OBJECTIVES

- Priorities constantly changing. Trends include nutrition. Breeders attempt to combine quality and disease resistance into one compact plant. Regional breeding, but should be more site-specific, especially in Hawaii.
- Pest resistance: Focus on major diseases based on crop loss. Many site-specific problems in Hawaii due to diverse climate and conditions, even between islands. Need to identify pests in your area and identify cultivars with resistance to your problems.



## HAWAII'S UNIQUE SITUATION

- A year-round breeding season is a major advantage for breeding tomatoes.
- Unfortunately, Hawaii is also a breeding ground for new diseases. Recent arrivals of Tomato Yellow Leaf Curl Virus and the recent identification of Pepper Mottle Virus create a moving target in identifying adapted cultivars.

# PROBLEMS IN BREEDING

- ◉ Good genes tightly linked to bad genes, especially in wild tomato.
- ◉ Both Root-knot nematode and Tobacco Mosaic Resistance tied to concentric cracking.
- ◉ May have to plant thousands of seedlings before you can find one with only the favorable gene.
- ◉ Many breeders have avoided breeding for resistance to these two diseases.

## ADDITIONAL CHALLENGES IN BREEDING

- New cultivars must be able to produce as much as older cultivars when disease is not present.
- Must address all problems or no improvement. Still gotta control diseases.
- Disease resistance is usually derived from wild lines; bring deficiencies back into the mix.

# ROOT-KNOT NEMATODES





# BREEDING TODAY

Breeding has become very complicated:

- ⦿ Not enough time to find one good gene at a time.
- ⦿ Using genetic markers to find a mass of good genes. A good tomato must have many good genes, not just a few.
- ⦿ Finding two parents with four good genes from each parent will give you eight good genes in a hybrid. Some diseases require resistance from both parents. i.e. TMV. May never find perfect tomato.

## HAWAII'S NEEDS

Our needs are very unique. We have diverse climates, over 140 soil types, and a year-round growing season with year-round pests. Our plants face extremes; drought, heat, heavy rain, and high humidity, creating conditions for diseases of all kinds. Cultivars must be acclimated to high night temperatures if grown in low lands.



## WHAT DOES THE COMMERCIAL HAWAII FARMER WANT

- ◉ Yield - high pack-out and grade-out \$\$\$
- ◉ Concentrated set (field production) \$\$\$
- ◉ Sustained production (greenhouse) \$\$\$
- ◉ Pest and Disease Resistance \$\$\$
- ◉ Vigor-fast germination & quick growth \$\$\$
- ◉ Shelf-life/Standability: non-cracking, firm fruit, Rough Handling \$\$\$
- ◉ Appearance - glossy, appealing to the eye \$\$\$



# GARDENERS CONSIDERATIONS

- ◉ Nutrition
- ◉ Eating Quality - balance of sweet & sour
- ◉ Harvest over long period of time
- ◉ High genetic variability - can select for resistance to problems, seed can be saved
- ◉ Multiple Disease resistance
- ◉ Efficiency in fertilizer use - not high input
- ◉ Large Root System - ability to withstand stress, late maturing
- ◉ Adaptable to Tropical Conditions - heat, rain, warm nights

# WHAT IS THE IDEAL GARDEN TOMATO?

- ◉ Nutrient rich fruit
- ◉ Excellent taste - explodes in your mouth!
- ◉ Late maturing - produce a large scavenging root system to sustain plant over a long fruiting season - 3+ months
- ◉ Utilizes nutrients efficiently = low input
- ◉ Adapted to tropical conditions: Heat & rain
- ◉ Resistance to many diseases found in Hawaii  
- V,F123,N,T,A,TYLCV
- ◉ Vigorous growth/genetic variability
- ◉ Uniformity not important

# SELECTING VARIETIES

Eliot Coleman's List of Priorities (Modified):

- ◉ Eating Quality
  - ◉ Pest & Disease Resistance
  - ◉ Days to Maturity
  - ◉ Standability
  - ◉ Time of Harvest
  - ◉ Ease of Cleaning
  - ◉ Ease of Preparation
  - ◉ Marketability
- Appearance
  - Vigor
  - Performance
  - Ease of Harvest
  - Adaptability
  - Convenience
  - Nutrition

# SORTING TOMATOES FOR RIPENESS AND COLOR





## BREAKING F1 HYBRIDS

- ◉ A novel way of developing a disease-resistant inbred for your area. Save the seeds from a F1. You may want to take fruits from several fruits instead of one. More variability since F1's are segregating for certain resistance. Plant at less-than-ideal times to express genes, then select what you want. If the disease is not present, you may not capture resistance in your selection. Overcome nematodes by grafting onto resistant rootstock.

# NEMATODE-RESISTANT TOMATOES

- ◉ Celebrity - F1
- ◉ Carnival - F1
- ◉ Milagro - F1
- ◉ Empire - F1
- ◉ Healani
- ◉ Anahu
- ◉ Abe Lincoln
- ◉ Apero (cherry)
- ◉ Favorita (cherry)
- ◉ Beaufort (rootstock)
- ◉ Maxifort (rootstock)

# FIELD TRIALS...

- ◉ Allow you to identify superior cultivars for your area for that season.
- ◉ Will show you what diseases you have in the area for that season.
- ◉ Will only tell you which cultivars grow well in that season or time slot.
- ◉ Keep the best and use to compare to new ones next season.
- ◉ Train your eyes to the intricacies of the different characteristics.
- ◉ Invite your friends to help evaluate. Everyone sees things differently.
- ◉ Know what you're looking for.

# FIELD TRIALS - MAY 2012







## TRIAL CHALLENGES

- ◉ Powdery mildew - 1 cultivar
- ◉ Russet mite - 2 cultivars
- ◉ Corn earworm - low populations (Dipel)
- ◉ Magnesium deficiency - high density planting
- ◉ Blossom-end rot - kona weather, high temperatures, water mgmt.



# POWDERY MILDEW



# RUSSET MITE = BRONZE STEMS





# RUSSET MITE SYMPTOMS



# BLOSSOM-END ROT (BOTTOM RIGHT)





## TAKE HOME MESSAGE

- ◉ Many tomato varieties grown in US may have resistance to many common diseases, especially those developed at universities.
- ◉ When selecting a variety, look for tomatoes having resistance to many diseases. (VFNTA designation)
- ◉ Exchange varieties with neighbors and friends, and compare these for adaptation.
- ◉ When a new disease comes in, some varieties grown in Hawaii may already have resistance.

# SEED PRODUCTION - UH CTAHR VOLCANO RESEARCH STATION





# HEALANI TOMATO

Resistance to:

- ◉ Tobacco Mosaic Virus
- ◉ Root-knot nematodes
- ◉ Vascular browning from still, wet weather
- ◉ Fusarium Wilt
- ◉ Stemphylium
- ◉ Alternaria
- ◉ Others

# HEALANI TOMATO





# HYDROPONIC MEDIA





# GREEN ONION SEED - KOBA





# GREEN ONION SEED





# KOBA GREEN ONION SEED





# HAPPY SEED SAVING !





**The End**

