Greenhouse Tomatoes and Growing Vegetable Transplants
Native to “tropical” America, most likely Andes Mountains of Bolivia and Peru

Mexico country of domestication?

Member of Night Shade Family (Solanaceae) along with Peppers, Eggplant and Potato

Botanically a Fruit (develops from an ovary), commercially recognized a Vegetable
Nutritional Content

- British thought it poisonous “fruit of evil spirits”, French “love apple”
- From Mexico to Mediterranean
- 1835 before cultivated here
- 16th among vegetables for vitamins
  - Vitamin A, Vitamin C, and Potassium
Lycopene

“world’s most powerful antioxidant”

- Help prevent many types of Cancer
- Contained in the red pigment of the fruit
- 5 times amount in cooked tomatoes
- Tomatoes = best source
  - Watermelon & Grapefruit
- Not synthesized in fruit air temp
  - Less than 50 F or above 85 F
Salicylates

- Found in tomatoes
- Aspirin-like substance
  - Reduce risk of heart disease
Why Transplant?

- Uneven Stand Establishment
- Short Growing Season
- Poor Soils
- Weed Control
- Early Season Marketing
Short Growing Season
Poor Soils—wet, late,
Jump on the Weeds
Early Marketing
Purchase vs. Growing

- Save Labor—someone else
- Greenhouse time—more vacation
- Fuel Costs—later season
- Aggravation?? It can be difficult
Grow Your Own

- Less Costly
- Greater Flexibility:
  - Variety Selection
  - Timing
- Quality Control
- Disease & Insect Issues
How to Grow Sturdy Transplants
Balancing Act

- Water
- Light
- Temperature
- Fertility
Leggy Plant
Causes of Leggy Plants & Remedy

- Shade
- Pro long cloudy weather
- Excessive Watering
- Too High Temperature
- Excessive Fertilizer
- Too Crowded Roots or Plants

- Full Sunlight
- Lower Day Temperatures
- As Necessary
- Skillful Management
- Less Frequently
- Bigger Pot/More Room
## Transplanting Difficulty

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General Cultural Practices of Tomatoes

- Crop Scheduling
- Cultivar Selection
- Plant Propagation
- Plant Spacing
- Pruning and Training
- Pollination and Cluster Pruning
- Harvesting and Storage
Crop Scheduling

Successive Plantings vs. Starting all at same time.

- 1st 2 houses month apart
- Next 6 houses 7-14 days apart

Why?

- Better Quality vs. More Efficient
- First 3 trusses large, gorgeous fruit
- Less disease issues
- Less worries about fine tuning
PLANTINGS

- 10 Plantings: **30,000 lbs.**
- March 17- June 15
- Ground heat to Inflation Busters—all with heat
- Focus on first 4-5 trusses—best quality, less disease worries, less fine tuning
- 30 years—move along
- 2-3 inches semi-composted cow/horse manure
- Soil test 4-5 years saturated media extract
Trusses later in the Season

Whole host of problems:
Leaf mold,
Botrytis
Abscission
Cultivar Selection
Variety Selection: Select For:

- FLAVOR
- Type of Tomato—Beefsteak, Cluster, Cherry
- Disease Resistance
- Days to Harvest
VARIETIES

- Geronimo – vigorous, disease resistant, great producer, late, ok flavor
- Big Beef/Goliath – early, excellent flavor & size, prone to tomato fulvia & green shoulder, 4 truss production, semi-deT. respond well to one sucker
- Tomimaru Muchoo – pink, incredible flavor, less acidic, 6-8oz.
- Big Dena – playing with this variety
- NO-Jetstar, BHNs, Rebelski, Trust, Mt.Merit, Charger, Clermon,
- Small: Sakura, Sunpeach, Black Cherry, the Tigers, Bumble Bees, Sungold
- Yes-Maxifort—uneven germinator but works, try DRO 141TX
- Heirloom- usual suspects; try F1 versions
Plant Propagation
Media for Transplants

- Should be lightweight
- Should have good drainage characteristics, but not dry out too fast
- Should be well aerated
- Should have low soluble salts
- Should be free of pests (weeds, diseases, insects, and pests)
- Mostly artificial mixes are used (peat based, although coir based mixes are growing in popularity)
- Compost-based mixes
Seeding

- Celery 1/8"
- Most other seeds ¼ to ½ "
- Larger seeds around 1 "
  - Sweet corn, beans, most cucurbits
- In most situations seed sized determines the depth of planting.

Optimum germination for most seeds is 75-85 F, but 90 F for many of the cucurbits.

Light, Light, Light

- 16 hours per day when seedlings
- 3--Hi Sodium Vapor lights
- Plants flower 1-2 weeks earlier
Transplants Grow Quickly Under Optimum Conditions—mid 70s by day & low 60s at night
Watering Transplants

- Very Tricky and Hard to learn
  - use hose with soft head
- Sunny and warm-early morning soak
- Sunny and Hot-early, mid, maybe late
- Cloudy and cool-spot watering or none
  - No ebb & flow, trough systems or capillary mat.
  - No Drip Tubes or overhead systems
Water & Fertility
low dose 15-16-17 -150 ppm.
2 week transplant—606, 806
Types of Containers
General Cultural Practices of Tomatoes

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- Pollination and Cluster Pruning
- Harvesting and Storage
2 week-old seedling
Grafted Plant
Ready for Transplanting 4 " pots
4 week un-grafted transplant—4” pot
30 Years in Big Tom
Nutritional Requirements
Soil Preparations
Ground Heat  60-70 F.
6-8 week old-Let’s Plant.
PLANT DENSITY

8 – 24 inches apart
512 – 134 plants
4-10 square ft./plant
Yields: 9-38 lbs./plant

Deciding Factors:
what are you trying to accomplish?

- Early Yield vs. Overall Yield
- Foliar Disease
- Single String or Sucker
- Plants grafted?
Early Yields

High Density 4 rows x 8 inches = 504 pl. = 4 sq. ft./pl.
Non-grafted Geronimos = 3 lb. per truss = 1,512 lb. x $4.00 per lb. = $6,048
Single Row “V” 12-24 inches apart, first sucker left
Environmental Requirements

- Temperature
- Light
- Relative Humidity
- Carbon Dioxide
- Air Movement
Temperature

- Bright Days:
  Day = 72-75 F
  Night = 64 F

- Dark Days:
  Day = 66-68 F
  Night = 60-62 F
Light
Why is it so!
Light

- Plant Matter is produced by the process of Photosynthesis
- Light is absorbed by the Chlorophyll (green pigment) in the green parts of the plant mostly leaves
- Atmospheric CO2 + H2O = Carbohydrates as sugars & starches.
- Greatly reduced without Light
Carbon Dioxide

- Enrichment does increase yields
- Most Important in Winter Crops
- More difficult in Spring/Summer Crops where constantly venting
Straw
String or Weave??
Tie
Pruning and Training
Truss Hooks
Flower Pollination
Vibrator or Bees
Abscission: When Fruit Fails to Set

Causes:

- **Adverse Temperature**
  - day=below 60F, above 90F
  - night= below 55, above 75F
- **Excessive Growth**
- **Poor Light**
- **Incorrect Nutrition**
- **Crop stress**
Cluster Pruning

- To Prevent Exhaustion of Plants
- Improve Fruit Size in early & later clusters
- Remove any misshapen or damaged fruit

- Prune first two clusters = 3 fruit
- Later clusters = 4 fruit

- Too much lead to Blossom End Rot
Harvesting
Store at 46-50 F; No, 60 F.
Disease Issues
Prevention
Ways to Reduce Diseases

- Cultivar Selection: resistant or tolerant
- Reduce opportunity: Good Sanitation
- Manipulation of Environment using different cultural practices
- Fungicides
Geronimo!
Cultivar Selection
Grafting
Sanitation

- Clean Seed: hot water treated
- Transplant into sterile, clean containers
- Roguing isolated infected plants
- Maintenance of areas surrounding fields or Greenhouses---weeding, mowing
Cultural Practices

Drier Foliage

- Staking, pruning and wider rows
- Horizontal Air Flow Fans
- Ground Plastic
- Roll up sides

- Lower Relative Humidity 60-75%
Fungicides

- Microbial Pesticides: Plant Shield = beneficial fungus *Trichoderma Harzianum*
  - Effective vs Pythium, Rhizoctonia, & Boytrytis
Insect Problems

- White Flies
- Tomato Hornworms
Vegetativeness vs. Reproductiveness

- Too much N. = Vegetative, poor fruit set & low productivity
- Too little N. = over-productivity leads to carbohydrate starvation, slow growth & low productivity
- Read the plant: Properly Nourished Plant = Stem 1 cm thick at a point 15 cm below the growing point
Read the Plants
½ inch thick 6 inches from growing point
Balancing Vegetative Growth with Fruit Production

Stress is the Key!

Options:

- N:K ratio
- Water management
- Leaf Removal
- Rootstock Vigor
Nutrient Requirements

Stage of Plant Development

- Prior to first flower: $N:K = 1:1$
- 1st cluster to 4th: $N:K = 1:1.5$
- Mature fruit to ripening: $N:K = 1:1.7$

- To boost vegetative growth increase N proportion
Irrigation Balancing Act

- Reproductive Growth
- Increase Water Stress

- Vegetative Growth
- Irrigate more often
Lots of Water!!!
Irrigation: Rules of Thumb

- 8-10% dry down = Vegetative Growth
- 17% dry down = Reproductive Growth
- Adjust water stress throughout day
  - Wetter earlier, drier later
  - Adjust water frequency to weather conditions and plant size
  - Frequent light irrigations are best
  - Avoid Chronic over or under watering
  - Avoid Daily Extremes
Blossom End Rot

- Blossom end of fruit turns light brown then black as the cells decay.

- Causes: In Combination
  - Calcium deficiency coupled with
  - Moisture Stress—Cloudy days no transpiration
  - Excessive fruit pruning (excessive hormones from the roots to developing fruit)
  - Low PH—calcium not available
  - High NH4 Ammonium availability
Staking and Weaving
Low Cost Tunnel Houses

- Inexpensive to purchase, build and maintain. 96 ft. x 14 ft.
- Recoup the capital cost the first year.
- Grow Less Plants: 2ft. Spacing = 138 plants.
- Weaving technique less labor than stringing.
- Only ground suckering.
Inexpensive

- 14 x 96 ft house, shoulder boards, base boards, gable ends of 2 x 4s, heater, fans, single poly cover, and black plastic ground cloth and labor = $3,250 +/-

- Yields 2,000 lbs. @ $2.75 per lb. = $5,500
Inexpensive

- 14 x 96 ft house, shoulder boards, base boards, gable ends of 2 x 4s, heater, fans, single poly cover, ground cover and labor = $6,000 +/-

- Yields 2,000 lbs. @ $3.75 per lb. = $7,000
Weaving Less Labor

- A Stake every other plant.
- Weave +/- 5 times
- Sucker ground suckers 1 time.
- That’s it Done-Harvest.
- Less Blossom abortion from heat
Fewer Plants

- More Greenhouse Space for other plants
- Fewer Plants to grow and care for.
Field Tomatoes
Good Luck!