NC STATE UNIVERSITY

History & Technique of Tomato Grafting

Suzanne O'Connell & Cary Rivard
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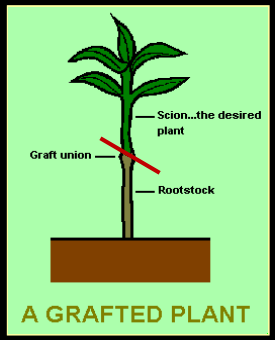
Tomato Grafting Workshop
Pittsboro, NC

Terminology

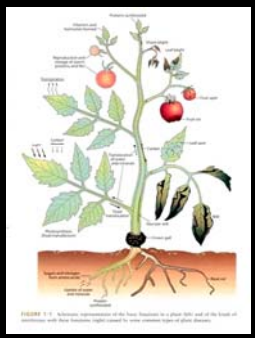


- Rootstock
- Scion
- Graft Union

http://www.asgap.org.au/gif/grafta.gif

Root Functions

- Water & nutrient uptake
- Nutrient assimilation & transport
- Relationships with 'good' microbes & mychorriza
- Disease resistance
- Hormone production
- Support anchor & food storage



Agrios. 2005. Plant Pathology. 5th ed.

Grafting History

- 1920s: watermelon
- 1950s: eggplant & cucumber
- 1960s: tomato & pepper

Popular Pairings:

Inter-generic:
watermelon/bottle gourd
cucumber/pumpkin
melon/wax gourd

Intra-specific:
tomato/tomato
eggplant/eggplant

Multiple eggplants on one plant

Photo by Mary Peet

Potential Benefits

Soilborne disease resistance

Decrease nematode damage

Superior quality fruit

Higher yields

Greater water and nutrient use efficiency

Increased tolerance to abiotic stressors

Black River Organic Farm, 2008. Ivanhoe, NC. Photo by Cary Rivard.

Common Rootstocks for Solanaceous Crops

- *Solanum lycopersicon (*aka *Lycopersicum esculentum)* 'Domestic Cultivated Tomato'
- *Solanum aethiopicum* 'Scarlet Eggplant'
- *Solanum torvum* 'Turkey Berry'
- ** most popular = Solanum Lycopersicon xSolanum Habrochaites (*aka *Lycopersicum hirsutum)* hybrid 'Domestic & Wild Tomato Hybrid'

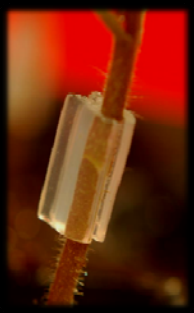
Photo by Dr. Jan Henk Venema, http://www.rug.nl/biologie/_shared/image/plantphysiology/combie1a.jpg

Decisions

- **Site Analysis & Rootstock Selection**
- Seeding/Transplant Production
- Tube Grafting Technique
- Healing Chamber Management
- Life on the Farm

Outline

- Site Analysis & Rootstock Selection
- **Seeding / Transplant Production**
- Tube Grafting Technique
- Healing Chamber Management
- Returning to Life on the Farm



Seeding / Transplant Production

- **Healthy Transplants**
- **Overseed**
- **Uniformity is key**
  - **Germination period**
  - **Substrate**
  - **Transplanting**

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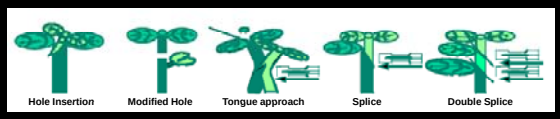
Different Grafting Methods

Cucurbits: Melon, Cucumber, etc.



Solanaceous: Tomato, Pepper, Eggplant

(Lee, 2003)

Tube-Grafting

- Seedlings are grafted at 2-4 leaf stage
- High throughput
  - One person can make ~ 300-500 grafts/hour
  - Grafting robots 600-1200 grafts/hr.

Photo by Helper Robotech Co., Korea

Photo by Mary Peet

NCSU Throughput

Grafting Technique

- Preparing for surgery…
  - Make sure plants are not water or nutrient stressed
  - Have a clean working area
    - Disinfect hands, tools, and grafting clips.
  - Carry out grafting indoors (cloudy day or late afternoon best time)
  - Be in close proximity to healing chamber

Grafting Technique

- Angle of cut: ~ 45°
- Silicon clip attachment
- Scion insertion
- Provide good contact between the rootstock and the scion

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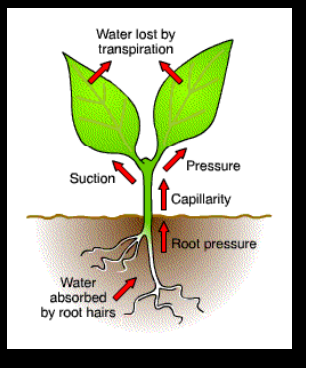
Life in the Chamber

- Move grafts promptly into a healing chamber
  - High RH (85-95%)
  - Cut out light
- Transport carefully
- Maintain Temp.
  - 75-80° F



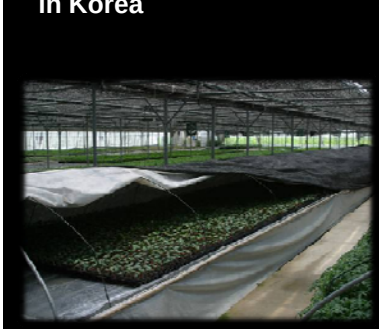
Basic Healing Chamber

Method Road Greenhouses, NCSU, 2006

Stefan Hartmann, Black River Organic Farm: Ivanhoe, NC

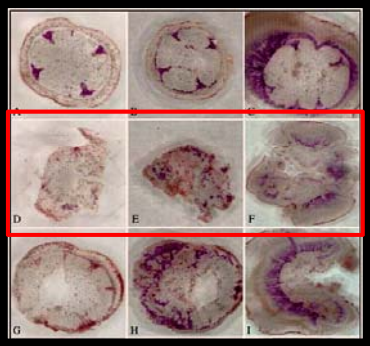
Phytotron NCSU, 2007

Large-scale Grafted Transplant Operation in Korea



Photos by Mary Peet , 2006

Lignin Development in a Tomato Graft



Fernandez-Garcia et al., 2004.

Life in the Chamber

- Regulate light
  - Indirect light
  - No light
- Regulate humidity
  - Cool-water vaporizers
    or
  - Passive humidifiers
  - NO OVERHEAD WATERING!!!

Life in the Chamber

- 2-5 days dark and high RH
- Allow indirect light once the plants have returned to normal turgor pressure for a couple of days.
- Slowly decrease humidity by raising the sides of the chamber.
- Take off plastic allowing plants to be exposed to normal RH and temp.
- Expose transplants to full sun.

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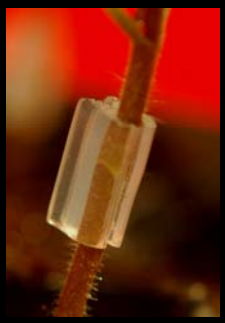
- **Returning to Farm Life**



Life on the Farm

- 7-10 days in the Greenhouse
  - Hardening off
  - Overhead watering
  - The clip
  - Transportation

Life on the Farm

Planting Depth

Suckering

Life on the Farm

Principles for Success

- Planning
- Uniform Seedling Production
- Grafting
- Healing Chamber Management
- Re-acclimation