Tomato Grafting Technique

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Vegetable Grafting:
An Old Technology with a New Technique

The belowground portion of a plant—the rootstock—is chosen for its genetic ability to resist or tolerate soilborne disease. The above-ground portion of the plant—the scion—is chosen based on fruit quality.

Grafting Worldwide

81% of Korean and 54% of Japanese vegetable production uses grafted plants (2012)

Benefits of Grafting

• Disease resistance against soilborne pathogens
• Grafting effective overcome abiotic stresses
• Water and nutrient uptake
• Increase productivity

Vegetable Grafting

快来加入我们，了解如何使用工具进行蔬菜嫁接。

Cucurbits (cucumber, watermelon and other melons)
• Hole-insertion grafting, One cotyledon grafting, and Approach grafting
• http://cals.arizona.edu/grafting/howto/cucurbits/grafting_methods
• Solanaceous (Tomato, eggplant and pepper etc.)

Grafting Information

http://www.youtube.com/watch?v=Q5QzDTA6J5Q
Grafting Information

Disclaimer

- No Recipe for Success
- Principles
  - Production
  - Uniformity
  - Water Stress
  - Sanitation
  - Re-acclimation

Disease and Variety

- Disease Diagnosis
- Variety selection
  - Scion
    - Wanted fruit characteristics
  - Rootstock
    - Disease resistance

Commercial Rootstock Selection

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Supplies and Space

- Clean Space
- Razor blades
- Alcohol or other disinfectant
- Grafting Clips
- Healing Chamber
**Propagation Costs**  
- Proportion of added costs  
  - e.g. seed costs (% of SEED<sub>graft</sub> - SEED<sub>non</sub>) / (TOTAL<sub>graft</sub> - TOTAL<sub>non</sub>)

  ![Cost Chart](image)

  NC Location: $0.46 / plant  
  PA Location: $0.74 / plant  
  Added cost = (Rivard et al., 2010)

**Tomato Grafting Techniques**

- **Cleft Grafting**
- **Tongue Approach Grafting**
- **Tube-grafting**

**Tube Grafting**

- The advent of “tube-grafting” or “Japanese top-grafting” has become the most popular for tomato.
  - Seedlings are grafted at 2-4 leaf stage.
  - High Throughput
    - A person can make ~1000 grafts/day
    - Grafting robots can make 700 grafts/hr.

**Timeline**

- **Tube Grafting Technique**

  - **Size:**
    - 2-4 leaves
    - 1.5-2.0 mm stem diameter
  - Sorting
  - Temperature can be manipulated to compensate for size differences.
  - Timing is critical.

**Seeding / Transplant Production**

- Uniformity is key
  - Germination period
  - Substrate
  - Transplanting / Sowing
- Rootstock and scion
- Numbers
- Plastic trays
Prepare 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
  - Be in close proximity to healing chamber

Tube Grafting Technique

- Angle of cut
- Clip attachment
- Scion insertion
- Provide good contact between the rootstock and the scion
Timeline

During the healing process, the plant has to form callus tissue and reconnect vascular bundles within the stem.
Life in the Chamber

- Objectives of the healing chamber
  - Reducing water stress by slowing the transpirational stream.
    - Humidity
    - Light
    - Temperature
  - Keep temperature fairly constant and between 75 and 80 degrees F.

Life in the Chamber

- Regulate humidity
  - Cool-water vaporizers
  - Humidifiers
  - Passive humidifiers
  - No warm-water vaporizers
  - Overhead watering

Small cool-mist vaporizer (~$40).
Note: 1.5” PVC connectors to direct water vapor

- Regulate light & humidity in the chamber
**Life in the Greenhouse**

- 7-10 days in the Greenhouse
  - Hardening off
  - Overhead Watering
  - The Clip
  - Transportation

**Life on the Farm**

- Suckering
- MAXIFORT
- NON-GRAFTED
- Twin leader for European string trellis
- Twin leader for stake-and-weave

**Reason for Graft Failure**

- Seedlings are unhealthy and improperly matched in diameter
- Small seedling grafting
- Insufficient sanitation
- Improper management of post-grafting environment
  - High temperature
  - High humidity
  - Direct overhead watering
  - Excessive light
  - Insufficient light

*Young et. al. 2009*
Sanitation

During Grafting and Healing
- Contamination is common during grafting, vulnerable plants
- Use alcohol to wipe down grafting area before and after use
- Dip or wipe cutting utensils in alcohol often
- Bleach grafting area after use
- Bleach humidifiers in between uses to reduce algae build up
- Clean healing chamber between uses
- Soak used grafting clips in bleach solution and rinse repeatedly
- Bleach and rinse propagation trays if reusing trays

Other Areas of Concern:
- Saving seeds?
  - Sanitize seeds in bleach to prevent seed borne pathogens after seed extraction
- Organic production, soil with damping off pathogens, Rhizoctonia and Phythium sp.
  - Steam soil if possible
  - Monitor and remove infected plants
- Extended periods of leaf wetness can lead to fungal problems such as leaf mold or powdery mildew
  - Adjust leaf wetness, monitor humidity and look out for water droplets on foliage

Review

- Uniformity of seedlings
- Timing
- Patience
- Sanitation
- Careful observation
- Water management
- Cultural Management

Important links for Grafting Information:

Informational Resources:
5. http://cals.arizona.edu/grafting/home

Grafting Supplies Resources:

Questions???