# Development and Implementation of Fruiting-Vegetable Grafting Technologies For Field Production Systems In The USA

Compiled by Frank J. Louws

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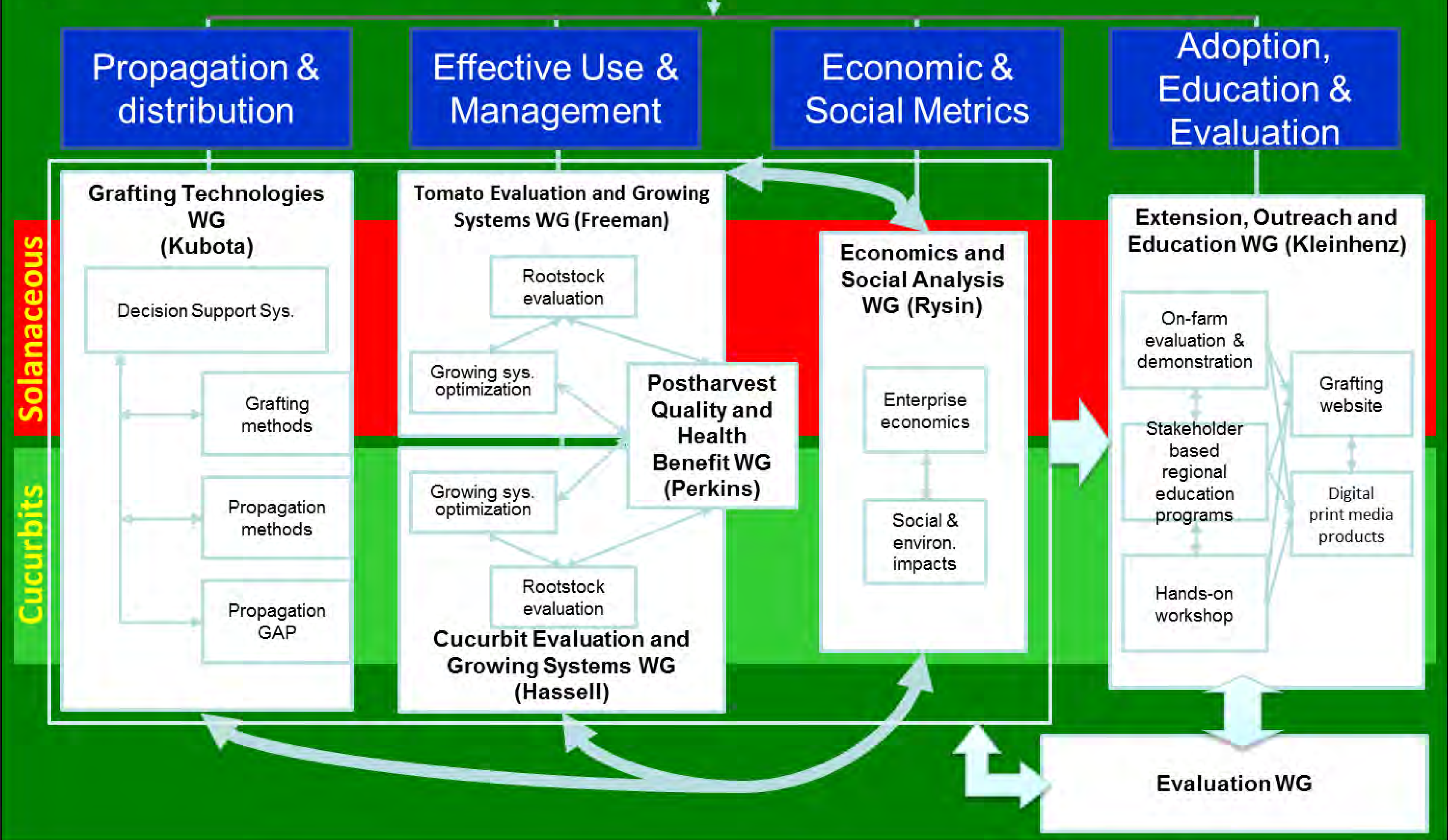
**SUMMARY:**

A national program was initiated to advance the productivity and profitability of US fruiting vegetable enterprises by integrating grafting technologies into these production systems through stakeholder-driven, systems oriented and trans-disciplinary strategic research, extension and education. Private partners in the project include organic and conventional producers, seed and robotics companies, industry publishers/educators, and research and extension personnel. Growers of fruiting vegetables (tomatoes and melons) face many environmental, technical and market forces that demand innovative solutions to overcome constraints or to expand into emerging markets. For example, much of the fruiting vegetable industry, particularly in the southern production regions, has relied on fumigation as the primary soilborne pest management tactic. Loss of methyl bromide and major fumigant label changes has made fumigant use a much less viable option. Likewise, several pathogens are poorly controlled by fumigants or IPM tactics and growers seek efficient use of water, nutrient, and land resources. In addition, emerging markets include extended season production using high tunnels, organic and specialty cultivars, changing demographics and increased consumer demand for fresh vegetables for health. However, production is constrained due to lack of host resistance to biotic (e.g. disease) or abiotic (e.g. cold soils, high salt content) stressors not readily integrated into customer-preferred fruiting vegetable cultivars. The project advanced the capacity to produce and use grafted plants from the retail store level to large commercial farms to manage soilborne diseases and nematodes, increase tolerance to abiotic stress and increase yield and/or fruit quality. Work continues on opportunities and challenges.

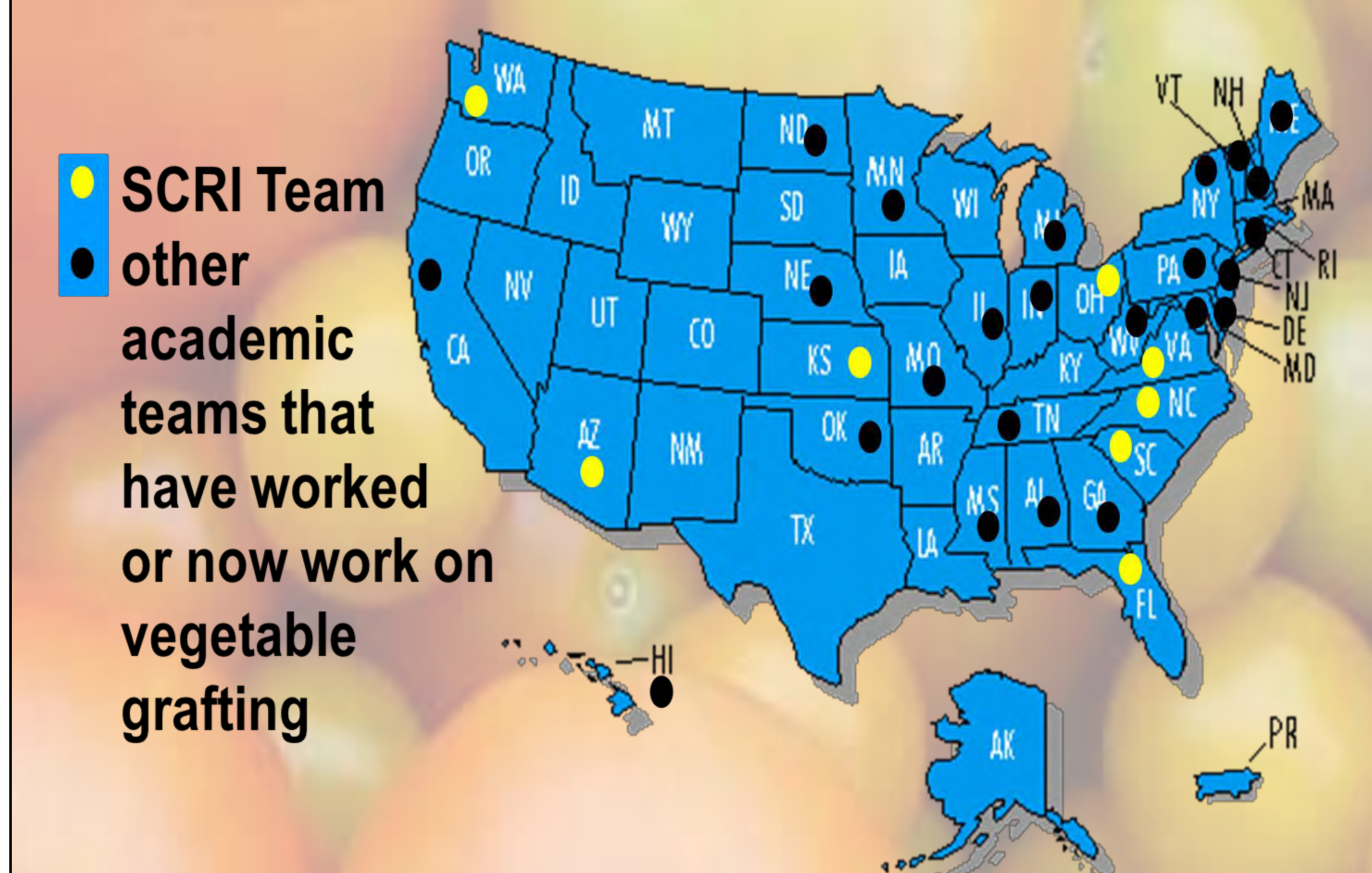
OBJECTIVES: The Four main objectives are organized along the top (Blue Boxes) to address grafting challenges and opportunities for both Solanaceous and Cucurbit crops. The program is organized by interdisciplinary working groups with sub-objectives that guide major outcomes and outputs (white).




## USDA SCRI GRAFTING TEAM CONTACTS

| Working Group | WG Leader | Institutional Leader |
|---|---|---|
| Grafting Technologies | Chieri Kubota | The University of Arizona |
| Solanaceous Systems | Josh Freeman | Univ. of Florida |
| Cucurbit Systems | Richard Hassell | Clemson University |
| Postharvest Quality | Penny Perkins | |
| Economic and Social Analysis | Olya Rysin | |
| Extension, Outreach, Education, Evaluation | Matt Kleinhenz | The Ohio State University |
| | Team Leaders | |
| | Nancy Burelle<br>Erin Rosskopf | USDA-ARS Fort Pierce FL |
| | Xin Zhao | Univ. of Florida |
| | Frank Louws | NC-State University |
| | Cary Rivard | Kansas State |
| | Carol Miles | Washington State |

## Sites of U.S. Vegetable Grafting Research-Extension-Teaching Activity




Outcome: Link the practice and science of grafting using international expertise as advisors and partners to develop "turn-key" businesses and use of grafted plants

Practice

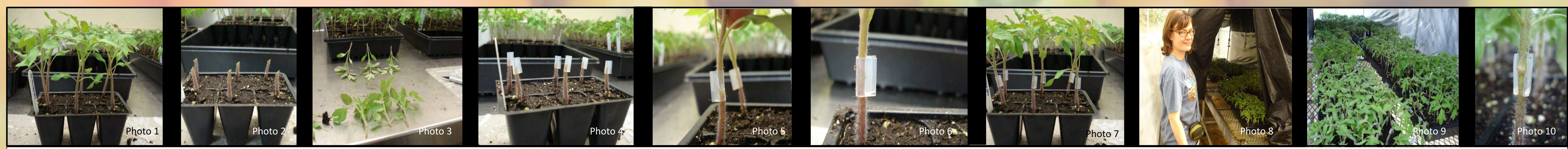
Science

**Partners – (Third Party Match)**

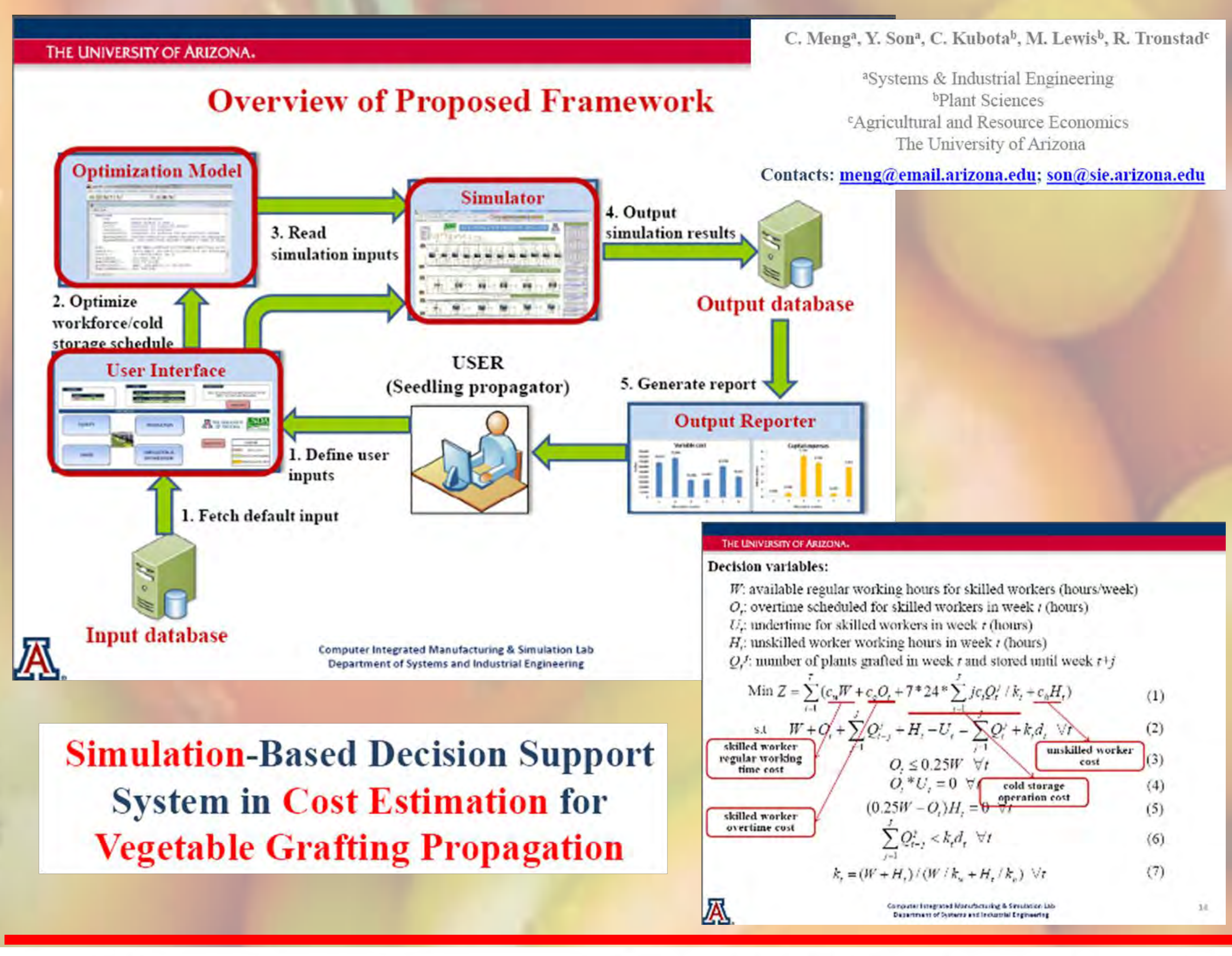
**53 private partners representing the global diversity of the industry including:**

- Multiple farmers throughout the US (OFR)
- Grower Associations
- Automation/Robotics companies
- Seed companies (especially rootstock seeds)
- Propagators/transplant growers
- Consultants & other Stakeholders

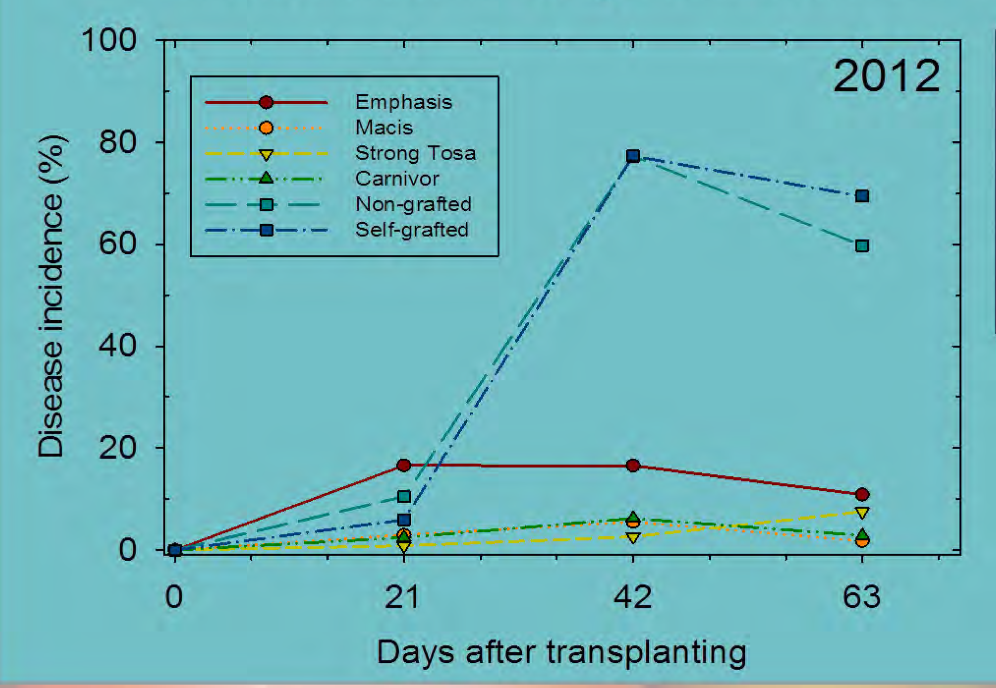
**Expand or create profitable business opportunities**



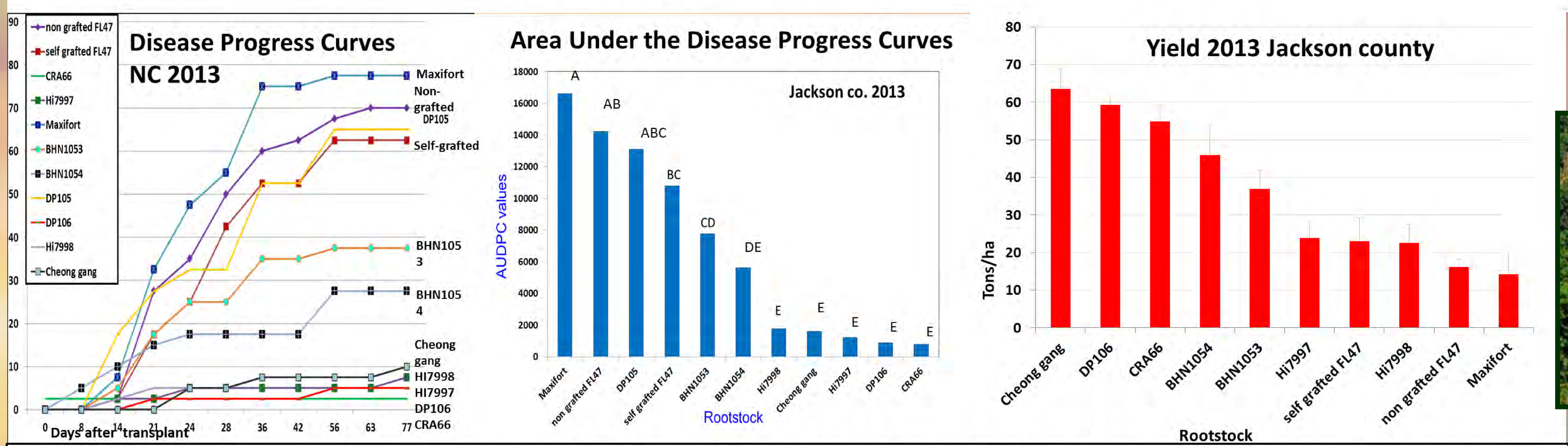

**The Grafting Process for Tomatoes:** Photo.1. Plants are grown to the 2mm stem diameter for grafting. Photo 2. Rootstock and scion are decapitated at a 45 degree angle. Photo 3. The scion is set aside and rootstock tops are thrown away. Photo 4. A silicon grafting clip is placed onto the rootstock cut. Photo 5. The scion is placed into the silicon clip on top of the rootstock. Photos 6 & 7. The union of the cut edges is visible inside the clear silicon clip. Photo 8. Plants then enter the recovery phase where they heal the graft union under low light and high humidity conditions. Photo 9. Plants start to recover within 2-3 days of low light and can gradually be weaned to higher light and then humidity an be reduced. Photo 10. The healing process is complete when the graft union has developed and the plants have started to grow (Compiled by Emily Silverman (insert)).




**Cucurbit Working Group: Seedless Watermelon: Incidence of Fusarium Wilt on Grafted and Non-grafted 'Fascination' with FON race 2**




Tony Keinath & Richard Hassell, 2013




**Above Figures: Example of on farm research to evaluate impact of bacterial wilt (*Ralstonia solanacearum*) on disease incidence, AUDPC values and Yield using various rootstocks and a common scion (FL47). (Emily Silverman; Jonathan Kressin; Dilip Panthee; Frank Louws NC State University).**


## Postharvest Evaluations

(Penny Perkins-Veazie, Xin Zhao)

Many research and extension products with recordings from 3 National Vegetable Grafting Symposiums with other resources are available at vegetablegrafting.org.

Thanks to USDA-SCRI Grant 2011-51181-30963

Thanks to all cooperators, growers and team members