

BIOAG PROJECT FINAL REPORT 2013

TITLE: Workshops: Grafting Vegetables for Soil-borne Disease Resistance

PRINCIPAL INVESTIGATOR(S):

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COOPERATOR(S): None

KEY WORDS: outreach, extension, vegetable grafting, tomato, watermelon, *Verticillium dahliae*

ABSTRACT

Tomato, eggplant and watermelon can be significantly impacted by soil-borne diseases in Washington. Disease problems can impact plants later in the season after most production costs have been incurred, resulting in a 25-75% crop loss in some years (John Loos, personal communication). Grafting vegetable crops onto resistant rootstock can provide an organic and sustainable alternative to soil fumigation for some soil-borne diseases. Grafting has been used successfully in Asia for nearly 100 years, but is only now being adopted in the U.S. In our previous project CSANR Project 76 (Miles and Inglis 2010-11), we developed Extension publications outlining a successful grafting technique for tomato and eggplant, and how to construct a healing chamber in the greenhouse. In this current project we: 1.) extended information regarding tomato, eggplant and watermelon grafting to Extension and NGO trainers, farmers, plant propagators, Master Gardeners, and university students; and 2.) developed a new fact sheet for watermelon grafting techniques. In Washington, we hosted 11 workshop presentations where 123 participants received hands-on training to graft tomato and watermelon. Master Gardeners have held small local training sessions to pass their information on to clients, including cooperators from demonstration gardens and home and community gardens. Miles also presented how-to vegetable grafting information at 5 events to a total of 114 participants, and she was an invited speaker at the International Grafting Symposium (Maitland, FL). Additionally, Miles and Kreider presented 7 workshops to farmers and trainer in Nicaragua to a total of 88 participants. We posted new information on the Vegetable Horticulture website for vegetable grafting <http://vegetables.wsu.edu/graftingVegetables.html>, and in 2012, this page was the second most visited page on the site (4,560 visits).

PROJECT DESCRIPTION

Organic producers in particular need alternative strategies to manage soil-borne pathogens such as *Verticillium dahliae*, which has a wide host range and can survive in the soil for up to 10 years. Grafting is a sustainable and effective integrated pest management strategy for controlling *V. dahliae* and other soil-based problems such as some nematodes and soil salinity. Although there is growing interest in vegetable grafting in the U.S., it has been adopted only on a limited scale due to lack of knowledge, limited availability of grafted vegetable transplants, high cost of commercial rootstocks, and added labor and expenses.

Based on our work done in the previous CSANR Project 76 "Vegetable grafting for *Verticillium dahliae* resistance" (Miles and Inglis 2010-11), extension publications outlining effective grafting techniques and healing chamber construction have been produced for tomato. Additionally, presentations have been developed and are available online at <http://vegetables.wsu.edu/graftingVegetables.html>. However, the previous project did not complete the publication of effective techniques for grafting watermelon. In the

current project we developed a fact sheet describing successful grafting techniques and healing regime to improve the success rate in grafted watermelon up to 75%. This has been a significant gain over our previous success rate of 20%; however, the commercial watermelon grafting industry has an 80% success rate, so improvements are needed in our grafting and healing methods.

The skill of grafting is still best conveyed by hands-on practice. It is particularly important that those who will train others should have actual experience in using the correct techniques. Both knowledge of the methods and skill in execution are necessary to ensure a good success rate for the survival of grafted plants. Our program has received numerous requests for tomato grafting workshops and presentations. We hosted 11 hands-on trainings for tomato and watermelon grafting in Washington and 7 in Nicaragua, and presented at the International Vegetable Grafting Symposium, the State Master Gardeners' Conference, and 3 other local events. A total of 325 participants directly received information from this project.

OUTPUTS

Work Completed:

Objective 1 of this project was to provide training to growers, plant propagators, Extension staff, and Master Gardeners on tomato grafting techniques, to enable participants to instruct their clients. A series of tomato and watermelon grafting workshops were conducted at WSU Mount Vernon NWREC and other locations in 2012 and 2013. In all, 11 workshops were presented to a total of 123 participants who received hands-on training in vegetable grafting.

Participant number at each workshop was limited to 20 to ensure quality one-on-one training. Participants were provided with plants of the tomato scion variety 'Cherokee Purple' and rootstock 'Beaufort.' Participants were also supplied with grafting clips, razor blades, gloves, and plant labels, all of which are used in grafting. An additional set of 40 grafted and 10 non-grafted plants were provided for two Master Gardener Demonstration Gardens and 13 individual Master Gardener home gardens. The Master Gardeners were encouraged to plant small demonstration plots to compare performance of grafted and non-grafted plants.

Objective 2 was to develop a fact sheet for watermelon grafting and healing chamber management to improve the current rates of plant survival, and develop presentations describing these techniques. A new fact sheet has been published that highlights the most commonly used technique for watermelon grafting, and also includes a description of a healing chamber management regime that results in good survival of grafted plants (75%). While this is a significant increase over our previous success rate of 20%, it is not as good as the success rate achieved by some commercial propagators (80%). Thus, more work is needed to improve our grafting success rate with watermelon.

Publications, Handouts, Other Text & Web Products:

1. Miles, C, L. Hesnault, S. Johnson, and P. Kreider. 2012. Vegetable Grafting: Watermelon. Washington State University Extension Publication FS100E. 7 p.
<http://cru.cahe.wsu.edu/CEPublications/FS100E/FS100E.pdf> .
2. Miles, C., S. Johnson, and D. Inglis. 2012. Managing Verticillium wilt on eggplant through grafting, and graft survival in healing chambers. Proceedings International Research Conference on Methyl Bromide Alternatives and Emissions Reduction, November 8, Maitland, Florida, p. 67.
3. Miles, C. 2013. Grafting Vegetables. Added new information to this website; 4,560 visits in 2012.
<http://vegetables.wsu.edu/graftingVegetables.html>.

Outreach & Education Activities:

Miles, C., and P. Kreider. 2013. Tomato, Pepper and Watermelon Grafting Workshops. Nicaragua, 7 locations, April 8-22. 88 participants total; organized by USAID Farmer-to-Farmer Program, Chris Beyer, chris@favaca.org.

Miles, C., and J. Wimer. 2013. Grafting Watermelon. WSU Mount Vernon NWREC, May 24, 2013. 26 attendees; contact: Martha Rosemeyer, rosemeym@evergreen.edu.

Miles, C. 2013. Grafting Tomato, Eggplant, and Watermelon. Bellingham Historic Museum, May 1, 2013. 25 attendees; contact: Tamera Hall, THall@alpha.com.

Miles, C., and P. Kreider. 2013. Grafting Eggplant, Tomato, and Watermelon. WSU Mount Vernon NWREC, April 24, 2013. 6 attendees from Cloud Mountain Farm, Everson, WA.

Miles, C. 2013. Grafting Tomato, Eggplant and Watermelon. Christiansons Nursery, Mount Vernon, March 23, 2013, 11:00-12:00. 18 attendees; contact: Kris Moe, Christiansons Nursery, kris@christiansons@gmail.com.

Miles, C., and P. Kreider. 2013. Grafting Tomato and Watermelon Workshop. WSU Mount Vernon NWREC. February 12, 2013, session I 9:00-12:00, Session II 1:00-4:00. 35 attendees total; contact: Anne Schwartz, Tilth Producers. als@fidalgo.net.

Miles, C., and P. Kreider. 2012. Tomato and Watermelon Grafting Workshop, Benton/Franklin County Extension, WSU Prosser IAREC, 9:30-12:00, November 19, 2012. 17 attendees; contact: Marianne C. Ophardt, 509-735-3551 ophardtm@wsu.edu.

Miles, C., and P. Kreider. 2012. Tomato and Watermelon Grafting Workshop, Yakima County Extension, WSU Prosser IAREC, 12:30-3:00, November 19, 2012. 18 attendees; contact: Marianne C. Ophardt, 509-735-3551 ophardtm@wsu.edu.

Miles, C., S. Johnson, and D. Inglis. 2012. Managing Verticillium wilt on eggplant through grafting, and graft survival in healing chambers. Proceedings International Research Conference on Methyl Bromide Alternatives and Emissions Reduction, Nov. 8, Maitland, Florida.

Miles, C., and P. Kreider. 2012. Tomato and Watermelon Grafting Workshop, Osborne Seed Company & Graham Kerr, WSU Mount Vernon NWREC, October 4, 2012. 2 attendees; contact: Ada Crawl, Product Development, 360-424-7333 www.osborneseed.com and Wendy Pilcher, Kerr Corporation, 360-387-3807 kerrcorp@wavecable.com.

Miles, C. and S. Johnson. 2012. Grafting vegetables for disease resistance. Master Gardener State Conference, TRAC Center, Pasco, WA, September 13, 2012. 45 participants.

Miles, C., and P. Kreider. 2012. Tomato and Watermelon Grafting Workshop, Osborne Seed Company, WSU Mount Vernon NWREC, September 28, 2012. 4 attendees; contact: Ada Crawl, Product Development, 360-424-7333 www.osborneseed.com.

Miles, C., and P. Kreider. 2012. Tomato Grafting Workshop, Clallam and Okanogan County Master Gardeners, WSU Mount Vernon NWREC, May 14, 2012. 4 attendees from Okanogan; contact:

Theresa Miller, 509-422-7245 tmiller@methownet.com; 14 attendees from Clallam; contact: Muriel Nesbitt, 360 565-2679 mnesbitt14@gmail.com.

Miles, C., and P. Kreider. 2012. Tomato Grafting Workshop, Greenbank Farms Extension Program, WSU Mount Vernon NWREC, April 19, 2012. 8 attendees; contact: Sebastian Aguilar, 360 222-33171 trainingcenter@greenbankfarms.com.

Miles, C., and P. Kreider. 2012. Tomato Grafting Workshop, Pierce County Master Gardeners, WSU Mount Vernon NWREC, April 4, 2012. 15 attendees; contact: Megan Aumiller, 360 897-1021 john528@centurytel.com.

IMPACTS

- **Short-Term:** Workshop participants were made aware of vegetable grafting as a method to control soil borne disease such as Verticillium wilt (*Verticillium dahliae*) in tomato, eggplant, and watermelon, the timing needed to coordinate seeding of rootstock and scion varieties to ensure stem compatibility, and the construction and management of a healing chamber. Participants successfully grafted tomato, eggplant and watermelon plants, and acquired the ability to instruct staff and clients in these techniques. We further refined grafting methods for watermelon and published a watermelon grafting fact sheet.
- **Intermediate-Term:** Staff and clients trained by workshop participants will be able to practice and master the hands-on techniques of tomato grafting, and develop a greater understanding of the reasons behind its use. Trainee participants will have the resources to carry out a successful program of tomato grafting in their operations and programs, including commercial vegetable farms, demonstration gardens, and community gardens as well as home gardens. An improved success rate for grafted watermelon will improve overall productivity and encourage further adoption of this pest management technique.
- **Long-Term:** Use of grafting to control soil borne diseases of tomato and watermelon will become a well known practice for commercial agricultural professionals and the general clientele of gardeners at the community and home level. Where applicable, grafting techniques will be extended to other crops such as cucumbers.

ADDITIONAL FUNDING APPLIED FOR / SECURED

CAHNRS EMERGING RESEARCH ISSUES - Grafting watermelon: A new sustainable management practice for soilborne disease and a new value-added enterprise for Washington, \$49,938 received for 2013
CSANR - On-line Training Module for Grafting Vegetable Transplants, \$4,908 to be received for 2013
NARF - Screening Watermelon Rootstock for Tolerance to Verticillium Wilt, \$ 2,675 received for 2013
WSCPR - Identifying Watermelon Rootstock with Resistance to Verticillium Wilt, \$5,000 requested for 2013 \$3,000 funded 12/14/12
WSDA – Using grafted watermelon to manage Verticillium Wilt in Washington, \$50,000 requested for 2013, this proposal was not funded

GRADUATE STUDENTS FUNDED: None

RECOMMENDATIONS FOR FUTURE RESEARCH

Improve watermelon grafting to increase success rates above 80%,
Screen watermelon rootstocks for resistance to *Verticillium dahliae*.
On-farm trials in the Columbia Basin to evaluate watermelon grafted on resistant rootstock.