

## BIOAG PROJECT PROGRESS REPORT

**Title:** On-line Training Module for Grafting Vegetable Transplants

**PRINCIPAL INVESTIGATOR:**

Carol Miles, Vegetable Horticulturist, Department of Horticulture, Washington State University Mount Vernon Northwestern Washington Research and Extension Center, 16650 State Route 536, Mount Vernon, WA 98273; [milesc@wsu.edu](mailto:milesc@wsu.edu); 360-848-6150.

**KEY WORDS:** Vegetable grafting, transplants, disease control, on-line resources

**ABSTRACT**

Grafting vegetable crops onto resistant rootstock can be an effective organic and sustainable strategy to manage soil-borne diseases such as Verticillium wilt, which is a common disease throughout Washington. Grafting has been used successfully in Asia for commercial vegetable production for nearly 100 years, but is only now being adopted in the U.S. In this project, we are refining our watermelon grafting technique with the goal of attaining grafting success of 90% or greater (industry standard is 80%). To improve our grafting techniques and collect new information, we visited two commercial grafting facilities near San Diego, California. We are creating an on-line Adobe Presenter training module to demonstrate how to successfully produce grafted watermelon transplants. We have hosted several hands-on trainings for vegetable grafting, and we have translated two Extension factsheets on vegetable grafting into Spanish. All new information is posted on our website <http://vegetables.wsu.edu/graftingVegetables.html#information>.

**PROJECT DESCRIPTION**

Successful watermelon grafting is very difficult, and after 3 years of experimentation, we have achieved rates of 75% - 80%, which is equal to the industry standard for watermelon grafting but less than success rates for tomato (98%). We visited two commercial vegetable grafting operations in San Diego, CA, and learned about their grafting and healing techniques. We have revised our methods and are conducting replicated studies in the greenhouse to evaluate success. Our goal is to achieve a success rate of 90% or greater. We have developed a PowerPoint presentation on watermelon grafting which we will narrate and post on our website. The training is targeted to the vegetable transplant industry, vegetable growers, and home gardeners. We have continued to host hands-on training for vegetable grafting. Additionally, we have translated two Extension publications on vegetable grafting into Spanish. The transplant/nursery industry in Washington, and throughout the U.S., predominantly employs Spanish-speaking labor, and these new publications will make new information accessible to managers who oversee this work as well as the labor force that is responsible for implementation.

## **OUTPUTS**

Work Completed: We were invited by Masaki Kashiwagi, Takii Seeds (one of the primary suppliers of vegetable grafting rootstocks in the U.S.), to visit a commercial operation near San Diego, CA, to view large scale cucurbit grafting. We toured this facility during cucurbit grafting on 12 March 2013, and interviewed the owner/operator and the grafting staff. We photographed grafting and healing methods and have used these in our presentations and to guide our on-going research. We also visited Plug Connections and met with their owner/operator and several staff members. This company is now likely the largest supplier of grafted tomato in the U.S., they are expanding into pepper and eggplant, and they just hired a watermelon grafting specialist from Turkey who we met with. We have also incorporated photographs and new information from this operation into our grafting presentations and methods.

We are testing several new grafting methods which we observed during our site visits, and have conducted replicated studies in the greenhouse to evaluate success. In addition, we are testing several healing regimens (how long plants are left in the healing chamber, and how many hours each day plants are exposed to ambient greenhouse conditions). In our experience, healing regimen appears to be the primary factor impacting grafting success.

We have completed the slides for a new narrated PowerPoint on watermelon grafting. Originally, we had intended to create a video, however Bob Hoffman was released from his position at WSU prior to our initiating this task. The narrated PowerPoint highlights the use of the 1-cotyledon method for grafting watermelon (the simplest and most successful technique in our experience) and emphasizes the importance of modifying the healing regimen based on plant symptoms (wilting, adventitious root formation), as this is the most critical step to plant survival.

Publications, Handouts, Other Text & Web Products: We have translated two Extension publications into Spanish. One focuses on tomato and eggplant and has been published by WSU and is posted on our website

<http://vegetables.wsu.edu/graftingVegetables.html#information>.

The second focuses on watermelon, it is in the external reviewer phase at this time, and will likely be published by WSU in April 2014.

Outreach & Education Activities: We hosted 3 hands-on trainings in Washington in 2013, and delivered 7 trainings over a 2-week period to famers and educators in Nicaragua. We also presented at 5 meetings and 2 conferences in Washington in 2013. A total of 467 participants received information through these events.

Feb 13 Tilth-sponsored vegetable grafting workshops (1 in the morning, 1 in the afternoon), WSU Mount Vernon NWREC (38 participants)

Mar 23 Vegetable grafting presentation, Christianson Nursery, LaConner, WA (16 participants)

Apr 8-22 Vegetable grafting hands-on trainings, Nicaragua (80 participants)

- Apr 24 Grafting eggplant for commercial field demonstration WSU Mount Vernon NWREC (8 participants)
- May 1 Vegetable grafting presentation, Birchwood Garden Club, Bellingham, WA (25 participants)
- May 24 Vegetable grafting presentation, Evergreen State College class, WSU Mount Vernon NWREC (55 participants)
- May 30 Vegetable grafting presentation, Washington State congressional representatives and staff, WSU Mount Vernon NWREC (25 participants)
- Aug 7 Vegetable grafting presentation, Hood River Gorge Growers, Hood River, OR (10 participants)
- Sept 26 Vegetable grafting presentation, WSU Master Gardeners State Conference, Everett, WA (130 participants)
- Nov 13 Vegetable grafting presentation, Pacific Northwest Vegetable Association Annual Conference, Kennewick, WA (80 participants)

#### **IMPACTS**

Short-Term: In Washington, 42 people received hands-on training in vegetable grafting, and an additional 425 people learned about vegetable grafting from oral presentations. We anticipate that our new on-line narrated presentation will be viewed at least 100 times annually. Participants will become aware of vegetable grafting as a method to control soil borne disease (e.g. *V. dahliae*) in vegetable crops, will understand the timing to coordinate seeding of rootstock and scion varieties, and the construction and operation of a healing chamber. We are providing grafting technical assistance to Northwest Transplants, the primary supplier of watermelon transplants for the Columbia Basin. Their managers attended one of our hands-on trainings, and they intend to test market grafted watermelon in the Columbia Basin in 2014.

Intermediate-Term: Increased education provided through on-line presentations for vegetable grafting will strengthen the ability of both home and commercial growers to master techniques of vegetable grafting and develop a greater understanding of the reasons behind its use. On-line presentations will be a resource that will help viewers to carry out a successful vegetable grafting program in their operations, including commercial vegetable farms, demonstration gardens, community gardens, home gardens, and high school science projects.

Long-Term: Use of grafting techniques for control of soil borne disease of eggplant and watermelon will become an established pest management practice throughout Washington and will replace soil fumigation as the primary control strategy for soil borne disease. Vegetable grafting will be utilized by commercial agricultural professionals and by the general clientele of gardeners at the school, community, and home level.

**ADDITIONAL FUNDING SECURED:** Related funding was obtained from WSU Emerging Research Issues grant for research to evaluate new potential watermelon rootstocks

with resistance/tolerance *Verticillium dahliae* and to conduct field trials in 2014 (\$49,938 for 2013; \$29,996 pending for 2014). Funds support an MS graduate student, Jesse Wimer.

**GRADUATE STUDENTS FUNDED:** None funded by this project, however a graduate student, Jesse Wimer, is working on vegetable grafting research (focus is on watermelon) and there is some overlap in tasks.

**RECOMMENDATIONS FOR FUTURE RESEARCH:** For vegetable grafting to be successful, it is first necessary to identify rootstocks with resistance/tolerance to specific pests and problems. Future research should include screening commercially available rootstocks, resistant cultivars, and germplasm available through the National Plant Germplasm System (NPGS). In addition to disease resistance/tolerance, potential rootstocks need to be tested for grafting compatibility with the target crop. The next step is to evaluate grafted plants under field conditions to determine if there is a benefit to using grafting as a means for control. For example, in our previous research we showed no benefit (disease control, yield, and fruit quality) for using grafted tomato as compared to ungrafted tomato in Mount Vernon and the Columbia Basin. Enterprise budgets need to be constructed in order to determine the cost-benefit analysis of using grafting plants, and comparing these to other methods of management to determine the economic benefits as well as sustainability of this new crop production practice. And finally, hands-on grafting demonstration and on-farm trials need to be conducted each year so growers can see firsthand how to graft and what the benefits are from using grafted transplants. It takes many years of on-going education and demonstration to create change in production practices.