

## Project narrative

**Project title:** Introduction of grafting as a new IPM tool in Arizona melon production

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**Project team members:** Mary Olsen, Specialist, Department of Plant Sciences, The University of Arizona, molsen@ag.arizona.edu; Michael A. McClure, Professor, Department of Plant Sciences, The University of Arizona, mcclure@Ag.arizona.edu

**Location for research/extension effort:** The research will be conducted at The University of Arizona Campus Agricultural Center, with statewide/nationwide dissemination and outreach efforts.

**Critical issue/situation to be addressed:**

Western states in the U.S. have experienced a rapid population increase, while continuing to serve as major food production sites. To sustain agricultural food production, while maintaining steady economic growth, agricultural IPM is crucial. Since the 1970's a generation of U.S. vegetable growers including those in the Southwest has relied upon soil fumigants to control soil-borne pests in high value, fresh market vegetable production systems. Major challenges to identifying fumigation alternatives include the additional costs of alternatives, a limited spectrum of activity against soil-borne diseases/pests and issues relating to worker exposure. Therefore sustainable alternatives must integrate several effective techniques of disease/pest control.

Grafting has been used for many years worldwide, to achieve resistances to soil-borne diseases and nematodes, to increase yield and product quality, and to improve plant stress tolerance over chilling and salt stress. Yield increases usually outweigh the cost of introducing grafted seedlings and, therefore, this technology was quickly accepted by farmers in Asia, Europe, and Central America. However, access to the information on scientific evidence and locally-conducted feasibility analysis are limited in the U.S. and therefore vegetable grafting is still relatively unknown to U.S. open-field farmers, while many rootstocks are commercially available worldwide. The rootstocks used for melon production in Asia are known to be resistant to *Fusarium spp.* and melon necrotic spot virus (MNSV), but obtaining locally collected data regarding the performance of the rootstocks over different pests and pathogens locally problematic to Arizona and Southwestern states is crucial to adopt the technology. Melons are an important commodity in Western U.S. vegetable production. Currently in Arizona, there are more than 30,000 acres of melons including cantaloupes, honeydews, and watermelons (Arizona Ag Statistics, 2000). In the central and southern counties of California, melons rank #34 in crop value at \$157,986,000 annually.

Results of a preliminary experiment conducted in fall 2006 indicated that grafting can be an effective means to overcome vine decline caused by charcoal rot (*Macrophomina phaseolina*) and Pythium root rot (*Pythium aphanidermatum*). Charcoal rot has become a problematic soil-borne fungal disease widely spread in Arizona, particularly in drip-irrigated fields. However, fumigation is known to have only little control over the *M. phaseolina*, and there are, so far, no biological control means developed for this disease. Since charcoal rot is not a typical problem in Asian melon production, where the most information on grafting and rootstocks is available, the rootstock performance over charcoal rot has not been documented in the seed/cultivar

registrations. In our preliminary experiment, all cantaloupe plants grafted on squash rootstock (*Cucurbita moschata*) survived, while all non-grafted cantaloupe plants exhibited a late-season vine decline. Most of these plants were infected with either *M. phaseolina* or *Pythium aphanidermatum* (usually both), but preliminary results indicate that at least 80% of the affected plants probably died from crown decay caused by *M. phaseolina*. The study indicated that grafting can be the potential biological control means for soil borne diseases such as charcoal rot and more data need to be collected to confirm the effectiveness of using the technology.

*Cucurbita moschata* rootstock is known to have a tolerance over root-knot nematode (*Meloidogyne spp.*), which is also problematic to Arizona melon production. In this proposed project, we plan to conduct a spring trial using a field infected with charcoal rot, *Pythium* and root-knot nematode. We also aim to evaluate the overall performance of the grafted cantaloupe plants. Since *C. moschata* rootstock is a traditional rootstock to achieve chilling tolerance in addition to the soil-borne disease/pest resistance, we will examine early planting expecting the early harvest of melons. The experiment will be conducted in collaboration with a local melon producer, Del Monte Fresh Produce, to collect data under conditions applicable to the commercial operation. This collaborative research affords a unique opportunity to study an IPM tool relatively unknown to Arizona for controlling multiple pests/diseases without negative impact to the environment and human health risks, consistent with APMC Goals and Priority Issues under Agricultural IPM.

**Inputs:** The proposed project is a collaborative effort among three faculty members of the Department of Plant Sciences. Dr. Chieri Kubota is a controlled environment plant physiologist specialized in seedling production and handling; Dr. Mary Olsen is an extension plant pathologist who has studied charcoal rot and other pathogens unique to Arizona melon production; and Dr. Mike McClure is a professor of nematology who has extensive experience in nematode control in Arizona soils. The project duration will be 6 months starting on January 1, 2007. The largest portion of the proposed budget will be spent for supporting a graduate student who will receive educational training through participation in the project. Project leader Dr. Kubota and her team members consider this proposed IPM project as a seed grant for locally collecting the necessary data in order to submit a relevant multi-state project proposal, as strongly suggested by USDA CSREES.

Table 1. Budget breakdown (January 1, 2007 to June 30, 2007)

Item	Amount
Plant Sciences graduate student (0.25 FTE for 4 months)	\$4,913
Plant pathology technician (0.50 FTE for 1 month)	\$1,512
Materials and supplies	\$575
Total request	\$7,000

**Outputs:**

An experiment will be conducted for the 2007 spring planting season for ‘Olympic Gold’ cantaloupe plants grafted on *C. moschata* rootstock (cv. Tetsukabuto, American Takii). A field plot known to be infested with *M. phaseolina*, *Pythium* and root-knot nematode will be selected, and no pre-planting fumigations will be applied. The experimental trials will be

designed as side-by-side comparisons of grafted and non-grafted seedlings planted early March. We will collect data for field establishment of the seedlings, overall performance of grafted plants in the field, diagnosis for the diseases/pests, and yield and quality of the harvested fruits. Comparisons will be also made in disease and pest incidences. Thirty grafted and non-grafted cantaloupe seedlings will be prepared for each planting (60 seedlings in total). Irrigation will be provided by drip irrigation as needed. The melon plants will be grown on three 84 inch wide and 90 feet long beds. The treatments will be arranged in a randomized complete block design.

Scientific and outreach publications (peer-reviewed journals and proceedings) are expected. Because the grafting technology is relatively unknown in the U.S., we hope to reach the scientific community, the stakeholders (commercial producers and potential propagators) and the extension personnel in the area of vegetable production and IPM. For this reason, we will give presentations at appropriate conferences (such as ASHS) and regional grower short courses (such as University of Arizona CEAC short course) and other IPM related conferences/workshops.

**Expected outcomes and impacts:**

An immediate benefit is expected for one of the stakeholders, Del Monte Fresh Produce (Contact person: Frank Mejia), a local melon producer, who expressed their strong interest and support of this project. Del Monte Fresh Produce grows melons on 10,000 acres of open-fields. They are particularly interested in adapting this technique for organic production of melons.

The medium and long-term outcomes and impacts will include other producers, propagators and seed companies who exist in Arizona and beyond. Because the source of grafted seedlings is limited in the U.S. while the demand can be huge (5,000 plants needed for every acre of planting field), the long term impact will include business opportunities to start specialized propagation operations using the unique grafting techniques. Such a new business opportunity of grafted seedling production has been discussed as a possible spin-off of the activities within the University of Arizona Controlled Environment Agriculture program with the cooperation of a local business organization. The CEA program considers grafting technology as a means of contribution from the modern greenhouse seedling propagation technology to the traditional open-field production. Therefore the results and outcomes will be disseminated statewide and nationwide using the available channels and lists of the CEA program network.

**Plan for evaluation:**

At the end of project, we will provide information to, and conduct surveys among extension agents and stakeholders including producers, seed companies and propagators in terms of the current awareness and the future expectations of grafting vegetable seedlings. Evaluation findings will be compiled in a formal report, and results will be presented to the collaborating industries and other relevant industries to get further feedback from these stakeholders.