Grafted Heirloom Tomatoes

Our Experiences in 2010

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David Redhage, Ranch Manager

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Background

Grafting is an old horticultural technique. It typically involves marrying a plant with desirable above-ground characteristics (called a scion) to one with desirable underground characteristics (the rootstock). In the U.S., grafting is especially common with woody plants such as fruit trees. It is far less common with vegetables, though the practice is quite popular in southeast Asia and other regions where intensive agriculture is common.

In this country, grafting tomatoes has gained attention, particularly for greenhouse culture. Using rootstocks resistant to fusarium and other problematic soil diseases, tomato growers are able to continue using popular and productive varieties that are otherwise susceptible. This interest extends to heirloom tomato production, whether grown in the field or in the greenhouse. Heirlooms are prized for flavor, color, and other qualities that are often lost from modern varieties as breeders pursue high yields, mechanical harvest, and shipping characteristics. These cultivars, however, often lack disease resistance and stress tolerance, and may have low productivity. If grafting remedies any of these concerns, heirloom tomatoes may become a much better option for the region's small market growers. Market growers, who sell in farmers markets or similar venues, are in an especially good position to take advantage of the benefits grafting might provide, since a small yield increase in high dollar heirloom tomato fruit would add quickly to profit. With this in mind, we planted a few grafted plants in 2009 to get familiar with them. In 2010, we planted a larger comparison trial, which we're describing in this publication.

Materials and Methods

We located the grafted tomato trial at the Cannon Horticulture Project on the Kerr Center Ranch. The Cannon Project was established in the fall of 2007 and is in transition to certified organic status. (Certification is anticipated in 2011.) The Cannon site features a loam soil with moderate to poor internal drainage, organic matter levels averaging 3.1%, and pH ranging from 6.6 to 7.0. Native phosphorus and potassium levels on these soils are typically low. However, compost applications in 2009 improved the phosphorus status considerably, and the potassium moderately. The crops preceding the tomato trial included sorghum-sudangrass, planted as green fallow in summer 2009, followed by a winter cover crop of triticale, purple vetch, and volunteer crimson clover.

The trial plot was prepared by mow-killing the winter cover crop with a sicklebar mower on April 29. The residue was raked to the side and a 2.5 foot wide ridge was formed using a rotary plow, powered by a BCS walk-behind tractor. Drip tape was promptly installed and the residue raked back into place as mulch. Supplemental grass mulch was added to the ridge where needed. Transplants were set out on May 21st and "mudded in" using a dilute transplant solution containing organic-

based catalysts and nutrients. At the time of transplanting, the soil temperature was 68° F – well above the minimum recommendation of 65° F. Cages were set in place in the days that followed.

We chose to grow Cherokee Purple and Brandywine varieties. Both heirlooms are popular at farmers' markets and occasionally requested by name. Cherokee Purple is considered well adapted to Oklahoma, Brandywine less so. Neither had performed especially well in our 2009 heirloom tomato trial. We therefore reasoned that improved performance would not only be readily detected, if it occurred, but especially welcome on varieties that were so marketable.

The 2010 trial featured grafted and non-grafted plants from both varieties. There were three replications with four plants in each plot. Oklahoma State researchers at the Wes Watkins Agricultural Research and Extension Center (WWAREC), at Lane, provided the transplants, both grafts and non-grafts. (WWAREC is certified organic by the Oklahoma Department of Agriculture, Food and Forestry.) We used Beaufort rootstock. Beaufort is one of the most common rootstock varieties in current use. It exhibits high resistance to nematodes, corky root, race 1 verticillium, tomato mosaic, and race 2 fusarium, moderate resistance to race 1 fusarium, and moderate vigor. (For technical details on grafting, see **Further Reading**.)

Following transplanting, we applied supplemental organic fertilizer on May 26, providing the NPK equivalent of 10.6-2.0-8.6 pounds per acre. Four times throughout the season, we applied dilute foliar fertilizer sprays made from fish emulsion, liquid kelp, humic acids, micronized minerals, and plant extracts. We irrigated as needed.

We made several applications of Surround® to reduce sunscald. Surround® is a formulation of kaolin clay that leaves a non-toxic grayish-white film when sprayed on plants. To control fruitworms and pinworms, we applied *Bacillus thuringiensis* and spinosad – both biological insecticides. Striped blister beetles became a problem in late summer. We used a blend of pyrethrum (Pyganic®), neem, and d-limonene – botanical insecticides – to suppress them.

Blister beetles – shown here attacking our chard planting – were a big problem in 2010.

Additional care is needed when growing grafted tomatoes. Transplants must be set so that the graft site on the stem remains above the surface of the soil. If the scion is in contact with the soil, it will set roots, thereby exposing itself to soil diseases and negating one of the main benefits of grafting. Unfortunately, this requirement means that gardeners cannot plant tall grafts deeply, as they often do when transplants become *leggy*. Furthermore, as grafted plants grow, the rootstock tends to grow suckers that need to be removed. This task needed to be done several times in early season.

Tomatoes covered with a whitish film of Surround® kaolin clay formulation, to reduce sunscald

Results and Conclusions

We set our plants rather late in the season, so harvest also began late. The first fruits were picked on August 4. We terminated the trial with a final harvest on October 18. The extreme heat of summer season caused several problems including low fruit set, sunscald loss, and greater-than-usual pest pressure. Striped blister beetles were a particular nuisance. We made a number of observations about grafting:

- We found no clear yield advantage to grafting in either Cherokee Purple or Brandywine. This is not entirely surprising. This land had been in pasture for decades and had little chance to develop populations of root knot nematodes, fusarium, and other soil pathogens that tomato grafting is intended to circumvent. If grafting had been beneficial to either variety, it should have appeared as a generalized increase in vigor. Unfortunately, that was not evident.[1]
- There was, perhaps, a slightly higher marketing percentage for fruit from grafted plants. This advantage was not great, however, and a more exacting trial would be needed to determine whether this advantage truly exists.
- We again confirmed that Cherokee Purple – whether grafted or not – is far better adapted than Brandywine, to the challenging growing conditions of Eastern Oklahoma. Cherokee Purple's yields were between 3 and 4 times as great. The extreme heat of summer 2010 probably accentuated the difference between varieties more than would normally be seen.

In summary and despite the limited findings in our trial, we continue to believe that grafting heirloom tomatoes can be advantageous to market growers; there is strong evidence from elsewhere in the South that this is so. The advantage, however, may not appear under all conditions. Where virgin soils or soils with long rotations are involved, the grower may not see an advantage from grafting; or not enough, that is, to justify the extra cost. We will continue to monitor the development of vegetable grafting as it evolves in the United States and hope to test it further in the future.

[1] Organic market farmers Mike Appel and Emily Oakley, in rural Cherokee County, Oklahoma, also grew some grafted heirlooms in 2010. Like us, they found no differences in performance between grafted and non-grafted varieties.

Further Reading

The following is a brief bibliography of articles, and extension and research publications relating to grafted tomatoes. They include some detailed discussions of techniques and guidance on where to acquire the proper grafting supplies. One entry (Territorial Seed Company) is also a source for grafted tomato transplants.

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About the Authors

George Kuepper is currently Sustainable Agriculture Specialist and Intern Program Coordinator for the Kerr Center for Sustainable Agriculture. Prior to this, he was Midwest Office Coordinator and Technical Specialist for the National Center for Appropriate Technology and the ATTRA Project, specializing in issues related to organic certification, compliance, and transition.

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