

## Grafting Heirloom Tomato Seedlings for Increased Productivity on the Small Organic Unit at CEFS

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Heirloom tomatoes are a popular niche market for the small-scale farmer, and grafting may be an effective tool available to those who wish to carry out organic management practices. In the present study, field trials at the Center for Environmental Farming Systems (CEFS) will be used to monitor three different heirloom varieties under two distinct management systems. Marketable and non-marketable yield production will be examined as well as overall disease resistance.

The cultivation of grafted plants began in the early 20<sup>th</sup> century, and is now carried out worldwide. Grafting has become popular due to its ability to reduce plant disease incidence, and increase productivity without the use of chemicals that may be harmful to agricultural and natural ecosystems. This technique has been used with many crops including melons, cucumbers, eggplant, and tomatoes (Oda, 1999). Cleft grafting, tube grafting (figure 1,5), hole insertion, and tongue approach grafting are methods of grafting used throughout the world. Grafting methods vary depending on the types of crops being grafted and the growers' preferences. Tomatoes are typically "tube grafted" due to its relative ease and high throughput capabilities.

Fig. 1 - Tomato seedlings are grafted using the tube grafting technique.



Soil-borne diseases caused by viruses, fungi, bacteria and nematodes pose a great threat to crops. Apparent signs of disease include smaller foliage size, thin weak stems, wilt, decreased quality and quantity of fruit, and an overall reduced life span of the plant (Rivero, 2003). These diseases are an exceptional threat to heirloom varieties because they show very little resistance. Studies have shown that only 54.4% of bacterial wilt susceptible plants survived first harvest and zero percent by the last harvest compared to 100 % survival of the grafted cultures up until the last harvest. Furthermore, yield per plant was 4 fold greater in grafted versus non – grafted plants (Tikoo, 1979).

Fig 2. – Grafted tomatoes are topped, and trained into twin rows.



The main purpose of this study is to compare yields with and without the use of 'Maxifort' rootstock. Furthermore, a training technique known as "twin-heading" will be evaluated to determine its ability to increase yields on a per plant basis (figure 2).

'Maxifort' rootstock was chosen due to its ability to increase yields and overall plant vigor. The heirloom varieties used for the CEFS field trial are German Johnson, Jubilee, and Cherokee Purple. Grafts were made by severing both the required rootstock seedling

as well as the scion seedling at a 45° and securing them with a silicon clip (figure 1,5). Healing takes place in a chamber where high humidity (85-90%) and low light levels

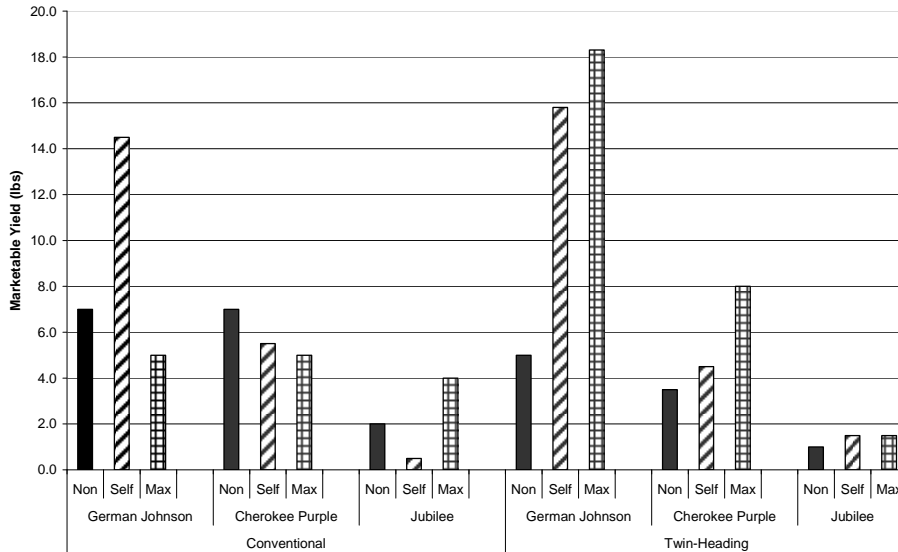
Fig. 3 - A simple healing chamber can be constructed using PVC tubing, plastic, and shade cloth.

allow for the plant to form callus tissue around the graft without being subjected to water stress (figure 3). By gradually reducing humidity levels and increasing light intensity, the grafted transplants are able to be returned to field conditions within 10-14 days (figure 5).



Although this is an incomplete data set, our preliminary data shows a trend for the ‘Maxifort’ rootstock in the “twin-heading” management system. In all three scion varieties, ‘Maxifort’ rootstock showed an increase in both total yield and marketable yield where “twin-heading” was used. (figure 4).

Marketable Yield as of 07/27/05 in Grafted Tomato Trials at CEFS



Based on previous studies and the preliminary study presented here, grafting and plant arrangement patterns may have a great influence on heirloom productivity. In the future, we hope to see an even greater

increase in yields produced from grafted varieties. Grafting has the potential to help small farmers overcome problems associated with growing heirloom varieties organically. It offers an inexpensive and relatively simple alternative to the use of pesticides.



Fig. 5 – In tube grafting, seedlings are held together by a 1.2 mm silicon clip until healing occurs. Once callus tissue has formed, the seedlings continue to grow and drop the clips, so they can be collected and reused.