Tomato Grafting Guide

Preparing Grafted Tomato Plants using the Cleft Graft Method

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Preparing and using grafted tomato plants can raise income potential, especially among smallholder farmers. To achieve this outcome, proper techniques must be used to prepare grafted tomato plants.

Grafted tomato plants are prepared in three major stages. First, the grafting site and materials, including rootstock and scion seedlings are prepared and assembled. Second, the rootstock and scion seedlings are grafted. And, third, the grafted plants are allowed to heal before transferring to the field, high tunnel or greenhouse.

The following pages are a step-by-step guide for completing the second stage (grafting) using the cleft graft method. Stage 2 (grafting) is the briefest and least costly stage.

Additional important information on vegetable grafting is available from various sources, including:

- **http://hcs.osu.edu/vpslab/**
- **http://www.facebook.com/osuvpslab/**
- **http://oardc.osu.edu/graftingtomato/graft.htm**
- **http://agsyst.wsu.edu/graftingVegetables.html**
- **http://cals.arizona.edu/grafting/home**

Rootstocks and scions must be seeded and grown in order that they are very close to the same size when at the best stage for grafting. Seedlings are most easily grafted before they become woody, before secondary growth is noticeable. Often, this coincides with both seedlings having 2-4 true leaves. Here, rootstock scion seedlings are being chosen.

The diameter of the stem of the rootstock and scion seedlings must be similar. If a mismatch is impossible to avoid, only the rootstock seedling stem diameter can be greater than the scion seedling stem diameter, not vice versa. Grafting two seedlings of similar size helps increase the likelihood that their vasculature will align during grafting. As plant's transportation system, the plant vasculature carries sap and water between roots and shoots.

The rootstock seedling is cut cleanly between (above) the cotyledons and first true leaves (below). Cutting at this point on the main stem helps reduce the likelihood that shoots (suckers) will develop from the rootstock. A clean and very sharp blade is ideal for all cuts but other commercial and home-made cutting devices have shown promise. Regardless, clean, disease-free plant stock, grafter hands, and work surfaces are highly recommended.

The decapitated rootstock seedling lacking any leaves is shown. The foliage of the rootstock seedling is discarded.

A home-made plastic clip is shown here. The clip has been cut from plastic tubing available at many locations and it is then sliced lengthwise. However, pre-manufactured clips are available. And, some success in securing the graft has been achieved with other materials (e.g., glue, wire, and strips cut from polythene bags). Regardless of material, the graft must be secured until it heals but also allowed to grow and not require removal by hand.

Slide clip down. If a tie is used to secure the graft, the tie will be put in place after the graft is made.

Rootstock with plastic clip.

In the cleft graft method, the trunk of the decapitated rootstock seedling is bisected cleanly to a depth equal to the bottom of the notch in the blade as shown.

The scion seedling is cut at the same point on the mainstem as the rootstock seedling, between the point of attachment of the cotyledons and first true leaves.

The roots and upper portion of the scion seedling are separated. The roots of the scion are discarded.

In our experience, trimming leaves from the scion seedling which will be grafted can be beneficial. Until the graft heals, including the stitching of the rootstock and seedling vasculature, the scion is unable to obtain water from the rootstock. Therefore, trimming leaves can lessen water loss. Of course, all cuts are wounds so the benefits of trimming leaves must be weighed against the risk associated with cuts, such as a heightened potential for disease.

In the cleft graft method, the stump of the scion seedling is cut to the shape of a two-sided wedge. Approximately one-third of each side (opposites) is removed at a roughly 45 degree angle. The first cut is shown here.

The flat surface of one cut at the base of the scion seedling stump is shown here. Note that each tissue type is a different color. The light green band and portions of the lighter-colored center comprise the vasculature which must stitch with its partner in the rootstock stump.

The stump of the scion seedling has been trimmed on both sides, creating a wedge with angled sides of approximately 45 degrees. Approximately two-thirds of the scion seedling stump has been removed.

The wedge-shaped scion stump is inserted into the cut of the bisected rootstock stump.

The plastic clip is slid into place to secure the graft. Once a rootstock and scion seedling are chosen, experienced grafters can graft them in one minute or less.

A Quick Guide to the Cleft Graft Method

I. Preparation

A. Rootstock and scion varieties must be genetically compatible. Therefore, select varieties proven to be compatible through experience or research.

B. Note that all the seed that are sown will not result in a grafted plant suitable for field use. Seedlings and grafted plants are lost in at least four ways:

1. Lack of emergence,
2. Seedling quality and survival (some seedlings may perish before grafting or be unsuitable for the process),
3. Graft survival (some grafts will be unsuccessful), and
4. Graft quality or survival (some grafts are successful but the grafted plant is not suitable for field use).

Therefore, when sowing seed, anticipate these losses. Then, sow more seed or purchase more plants than is required for fruit production.

C. The following facts also influence when and how many seed should be sown:

1. Seedlings grow at different rates depending on variety,
2. Rootstock stem diameter must reach a minimum size to graft, and
3. Rootstock and scion seedling stem diameters must be similar.

Therefore, early and repeated sowings are recommended.

D. Grafting only vigorous, disease-free seedlings is highly recommended. These seedlings may be easiest to produce in a low or high tunnel.

E. When preparing to graft, assemble the following:

1. Labor,
2. Scion and rootstock plants (some grafters presort plants according to size to save time),
3. New razor blades or scalpel,
4. Clips, glue, ties, or strips to secure the graft,
5. Sanitation supplies (e.g. alcohol, detergent, bleach or a commercial disinfectant for hands, surfaces and plants, oil burner, gloves, bench paper), and
6. Clean, climate controlled spaces to a) assemble grafts and b) heal and acclimate grafted plants. A low or high tunnel may be ideal for healing and acclimation.

II. Sanitation
   A. Minimize the onset of seed-borne disease; use clean, high quality, treated seed and avoid tobacco use. Seed suppliers and farmers can treat seed using recommended methods involving, for example, hot water and/or chlorine.
   B. Minimize disease transmission during growth; keep seedlings in a properly sanitized space and always wash hands before and after touching seedlings to prevent the mechanical spread of pathogens.
   C. Minimize disease transmission while grafting; always keep work spaces clean with detergents and alcohols, wear gloves while grafting, and use new or cleaned implements.

III. Grafting Process
   A. Select healthy rootstock and scion seedlings of a similar stem diameter.
   B. Using a sharp, clean blade, decapitate the rootstock seedling with a horizontal cut approximately 5 mm below cotyledons.
   C. Bisect the truncated rootstock stem at its widest diameter to a depth of 4 mm.
   D. De-root scion seedlings with a horizontal cut approximately 5 mm above the cotyledons.
   E. Trim the cut surface of the scion seedling to the shape of a wedge containing sides approximately 4 mm long. (In the two cut process, two diagonal cuts at a 65 degree angle are made that simultaneously separate the scion from its roots and forms the wedge).
   F. Insert the trimmed scion into the vertical slit of the rootstock.
   G. Secure the graft – a clip, tie, polyethylene strip, wire, glue or other clean material may be used.

IV. Healing and Acclimation
   A. Place new grafts in a climate controlled chamber with humidity at 90% (maintained by plastic), light reduced by 50% (maintained by shade cloth), and a temperature range of 18-21 deg C (day) and 16-18 deg C (night) for 5-7 days. Bottom watering is suggested in order to reduce stress on the graft union and limit the chance of decay.
   B. Place week-old grafts in a second post-graft chamber with humidity at 50% (maintained by plastic), light increased by the removal of the shade cloth, and a temperature range of 18-21 deg C (day) and 16-18 deg C (night) for 5-7 days. Bottom watering is still important to reduce stress on the graft union.
   C. Place two-week old grafts in an area with humidity, light, and temperature ranges recommended for acclimating tomato seedlings prior to planting.

V. Planting
   A. Plant the grafted plant so that the graft union remains at least 2.5 cm above the soil line. A rule of thumb is “don’t bury the clip,” if it remains. Proper placement of the plant limits root formation from the scion.
   B. Grafts may develop shoots from the rootstock and/or roots from the scion. Observe plants after planting; prune if needed.