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Grafting desirable fruiting varieties to vigorous, disease-resistant tomato rootstocks has become a cost-effective method for growers to overcome many disease and production-related issues. Grafting tomatoes can improve production and overall crop health, reduce or eliminate the need for pesticide use, lengthen harvest duration, and significantly increase net income. The entire process from sowing of rootstock and scion varieties to final transplanting of grafted plants into greenhouse soil or soilless medium normally takes 6–8 weeks.

The major advantage of side grafting is that this method is more forgiving of differing stem diameters than top grafting. This being said, getting a perfect match is not necessary, but the closer the 2 stems are to the same size, the better your chance of success. The disadvantage of side grafting is that it is more time-consuming to complete an individual graft and requires more materials than top grafting. If you are going to be grafting a large number of plants, top grafting may be advantageous, unless you already have plants whose stems don't match.

MATERIALS:

- Seeds of a rootstock variety.
- Seeds of a scion variety.
- Your preferred growing medium.
- Plug flats of your preferred cell size.
- Lightweight mesh trays.
- Shallow leakproof trays.
- Pots large enough for two root balls.
- A disinfectant, such as Virkon® or a 1:10 bleach solution.
- An old-fashioned, double-edged razor blade or spare blade of the Miter-Cut Grafting Knife.
- Spring-loaded side-grafting clips.
- A spray bottle.
- Humidity domes or a humidifier.



We sell 2 sizes of spring-loaded side-grafting clips that accommodate stems from $\frac{1}{16}$ – $\frac{1}{4}$ " in diameter. The best strategy is to have both types on hand, in case your plants get larger than you intend. If you plan on grafting on the smaller side, you can probably use the smaller, clear clips that will hold stem diameters from $\frac{1}{16}$ – $\frac{5}{32}$ ". If you plan on grafting larger plants, as pictured above, you can use the orange clips that work on stems from $\frac{1}{8}$ – $\frac{1}{4}$ ".

CHOOSING THE RIGHT ROOTSTOCK

Rootstocks fall into 2 broad categories: generative and vegetative. Generative rootstocks are less vigorous than vegetative rootstocks, but devote a higher proportion of their energy to the reproductive parts of the plant, which means they put more of their energy into flowers and fruit. Vegetative rootstocks put more of their energy into the leaves and stems.

Ideally, tomato plants are balanced, putting energy into growing the plant and the fruits at the same time. Picking the right rootstock means choosing the one that is most likely to balance the plant under the anticipated growing conditions. A well-balanced plant means that energy is going to sizing up fruits while also continuing to grow the vine.

A plant that is too generative is putting too much energy into growing and ripening fruits at the expense of plant growth. A plant that is unbalanced in a generative direction has a thin, weak head (top of the plant), and the developing flower trusses can be small and curled. You may notice that the vegetative parts of the plant do not seem to be growing very fast. Internodes tend to be shorter so the top flower cluster is closer to the head. Overly generative plants tend to peter out, as too much energy is going to fruits and not enough is going to build the vine for future growth.

A plant that is too vigorous will tend to have a relatively thick stem at the head, which may be oval instead of round. The developing flower cluster stem may be thin and held nearly vertical, instead of arching out from the vine. Overly vegetative plants tend to grow very fast, with longer distances between nodes, so the head is far above the highest truss. Tomato crops tend to start out very vegetative at the beginning of the season, before there is any fruit load to balance the plant, but it is desirable to balance the crop as soon as possible. A plant that stays overly vegetative may get large with relatively few fruits in proportion to the size of the plant, and the fruits may be slow to ripen.

Using any of the rootstocks we carry will add vigor to any scion variety to which it is grafted. Choosing the combination that will promote balanced growth is a matter of taking into account the type of fruit to be produced and the conditions under which the plants are grown.

ROOTSTOCKS

Vigorous, vegetative rootstocks are most appropriate for large-fruited (over 100 gm./fruit) varieties that will be in cultivation for over 6 months with 16 or more clusters picked. A vegetative rootstock will also help with crops that will be grown in hot areas. The hotter the 24-hour average temperature, the more vigor is needed to keep the plant growing well. The extremely high level of vigor imparted by rootstocks like Maxifort is useful to keep plants vigorous in long-season crops with above average temperatures.

Generative rootstocks are more appropriate for crops that will be growing for 6 months or less, with 15 or fewer clusters harvested, as with most crops in the field and unheated greenhouses. Generative rootstocks also work well with small-fruited (less than 100 gm./fruit) varieties in long-term cultivation.

Fruit Size	Crop Cycle Length	Rootstock Characteristics	Rootstock Variety
Large fruited (>100 gm./4 oz.)	Long cropping cycle, hot conditions expected.	Vigorous, vegetative rootstock.	DRO141TX Maxifort
Small fruited (<100 gm./4 oz.)	Any cropping cycle.	Generative rootstock.	Estamino
Large fruited (>100 gm./4 oz.)	Short cropping cycle.	Generative rootstock.	Estamino

PLANTING

Germination testing:

Do a germination test on each variety you plan to graft to observe the speed of germination and growth of the rootstock compared to the scion in your particular growing environment. Sometimes the rate of growth varies between rootstock and scion depending on growing conditions. The closer the diameters of the stems, the better chance you will have of a successful graft forming and healing.

Sow seed 6–8 weeks before your desired transplant date. Grafted tomato plants take 1–2 weeks longer to reach the transplant stage because they stop growing during the healing process. Overseed by at least 25% more than the number of plants you plan to transplant. Most tomato rootstocks are interspecific crosses (the product of traditional plant breeding crossing a *Solanum lycopersicum* domesticated tomato with a wild variety); this wide cross increases hybrid vigor but decreases germination percentage and uniformity.

If you test the varieties you will be growing for germination and growth rate, slower germinating or slow-growing varieties can be planted earlier, and faster growing varieties

can be planted 1–2 days later so the diameter of the stalks match as closely as possible at grafting time and increase the chance of success. If this is not possible, most rootstock and scion varieties can be planted on the same day.

Place the seeded flats into leakproof trays. These will provide extra support for when you are moving the flats from one location to another. Additionally, the trays will allow for bottom watering of the rootstock varieties both prior to and following grafting.

Maintain a steady 80°F/27°C temperature by using a germination chamber or heat mats with a soil probe to achieve this. Water the flats, cover them to conserve moisture, and germination should begin to occur within 3–4 days. To avoid leggy seedlings, move the trays to an environment with the same temperature and good light as soon as germination begins.

Once the seeds have germinated, after about 10 days, you can reduce the temperature to 64–66°F/18–19°C to encourage a stocky growth habit. Make sure plants have plenty of direct light and keep close track of their progress because they are growing quickly and will exceed the optimal size to graft in a very short time.

GRAFTING

Plants will be ready to graft approximately 17–21 days after sowing. Larger seedlings are generally used for side grafting because it is easier to make the necessary incisions on a larger stem. With a larger seedling, there is also more surface area for the tissue from the separate plants to connect.

You will need to prepare a clean area, such as a work bench, with no direct sunlight to do the cutting. An indoor area works well because the climate is more controllable, but an area in a greenhouse that is shaded and not too hot, 70–74°F/21–23°C, will work. Do not graft near a fan or draft.

Practicing grafting:

If you have never grafted tomatoes before, or need to get back in practice, the best way to succeed is to plant some old tomato seeds and practice with expendable plants. That way if the grafts don't take, you can analyze your technique and make improvements without setback.

Hygiene is very important during grafting because if you pick up a pathogen on your hands or equipment, you may transfer it to all of your plants. Do not smoke during grafting or near recently grafted plants, due to risk of Tobacco Mosaic virus. Wash your work area down with a disinfectant before grafting. Always start with new blades and grafting clips.

Prepare the healing chamber that will protect the plants until the graft has taken and keep the newly-grafted plants in a high-humidity, low-light environment so they do not respire too much and dry out before the vascular structure is reconnected. The clear propagation domes fit directly onto the flats and the vents in the domes allow for ventilating the grafted plants while they are healing. If possible, set up the healing chambers in the grafting location to prevent the plants being moved while they are still fragile.

Give your plants a normal watering the day before, but not the day of, grafting. Roots that are really wet will have too much moisture going up the stem, which can push the scion off and reduce the percentage of successful grafts. On the other hand, if you realize that the rootstocks are really dry as you are grafting them, stop grafting, water them, and resume grafting the next day because dry rootstocks will not survive.

First you will need to defoliate the plants. Defoliation will allow the plant to put more energy into healing after the graft has been made. Take a plant of your rootstock variety and a plant of your scion variety, both with stems of similar sizes. First use a blade to remove the lower leaves of each plant, then cut the top off of the rootstock variety.



Selecting a rootstock and scion of similar size.



Defoliating.



Further defoliation after the top of the rootstock has been removed.



The result of defoliation.

Make an upward cut $\frac{2}{3}$ of the way through the stem near the top of the rootstock. Then make a downward incision on the scion variety at approximately the same height, $\frac{2}{3}$ of the way through the scion's stem. Fit the incisions together with the rootstock's stem inserted into the incision on the scion's stem and place a spring-loaded side-grafting clip over the incision locations. Place grafted plants into a pot large enough to hold both root balls. They will need to be as close together as possible to place less stress on the plants as they heal. Fill in the pot with the growing medium of your choice, and place it into a mesh tray.



Making the incision on the scion variety.



Lining up the incisions.



Fitting the incisions together.



Securing the plants together with a spring-loaded grafting clip.



Placing the grafted plants in the same pot.



An alternative to using the spare blades of the Miter-Cute Grafting Knife is to take an old-fashioned double-edged razor blade and snap it in half lengthwise while it is still in its paper cover, being very careful not to cut yourself.

Place all of your pots into a lightweight mesh tray, then place this tray into a leakproof tray. By doing this you will be able to bottom water with the leakproof tray, but still be able to remove all of the pots at once to prevent them from getting over-saturated with water.

At this time you will leave the plants connected, so that there are 2 sets of roots and only the canopy of the scion connected at the graft union. Use a large clear propagation dome, placed over the top, to serve as the healing chamber. Spray the interior of the dome and the plants with the handheld sprayer. This will achieve the light, temperature, and humidity requirements of healing plants.

HEALING

Keep the vents on the dome closed, and maintain the healing chamber at 80–95% humidity and at a temperature of 80–82°F/26–27°C. Indirect sunlight (light shining in a window of the same room, as long as it does not fall directly on the plants) or artificial lighting is fine.

Direct sunlight or strong indirect sunlight may cause the healing chamber to heat up excessively, or cause the grafted plants to lean towards the light, pulling the graft apart. Check the plants from the outside of the dome. If they are wilting, raise the humidity level and reclose the chamber.

WEANING

After 3 days in the healing chamber, remove the domes and prepare to sever the scion variety's root system in steps. It is done in this manner to wean the grafted plant off of the second root system and prevent shocking the plant. Before cutting, attach the plants to a stake to help stabilize them and keep them upright. Then take a blade and cut only part way through the scion variety's stem. Replace the dome of the healing chamber and wait two more days before cutting the rest of the way through the stem.



A partial cut after healing for 3 days.



A full cut 2 days after that.

Once the scion root system has been severed, you may put the plants back in normal greenhouse conditions. It is a good idea to reintroduce the grafted plants to the greenhouse in the evening or on a cloudy day, to give them a chance to re-acclimate to regular growing conditions. If they wilt, put the domes back on and give them a little more recovery time before reintroducing to the greenhouse.

The key is to gradually bring the grafted plants to normal greenhouse temperature and humidity, but return to the previous conditions if they start to wilt. High-humidity conditions cannot be maintained indefinitely, or the scion may grow adventitious roots of its own and not fuse with the rootstock.

If flats need to be watered during the healing process, use bottom watering in the leakproof trays. Alternatively, you can also flood the bench they are on for a few minutes, or place flats in an inch of water so they can absorb it from the bottom. Top watering before the plants are healed may knock the tops off. Eventually the seedlings will be strong enough to top water again. After the plants have re-acclimated to greenhouse conditions for a few days they are ready for normal handling.

At transplanting, make sure the graft union is above the soil line, or the scion variety may root into the ground and negate the benefits of the rootstock. Prune off any suckers that develop below the graft union, as these are from the rootstock. Otherwise, manage the plant as you would normally.