

INTRODUCTION

Annual vegetable and field crops are normally propagated by seeds, but most perennial fruit species are propagated asexually to maintain characteristics identical to the mother plants and reduce the time it takes to fruit. Some species, such as grapes and pomegranates, can be propagated with cuttings, while others are most often propagated by grafting two distinct genotypes together. There are always two parts for grafting: the scion, which is the chosen cultivar, and the rootstock, which is used for the root system. The rootstock is often selected for characteristics such as disease resistance, plant size, precocity, and/or soil or climatic adaptability. In the nursery industry, inserting a single bud of the scion inside the bark of a rootstock (bud grafting or budding) in late summer is the most widely used method for propagating pome and stone fruits. However, jujubes (*Ziziphus jujuba*) have a thin bark and many side branches, making it almost impossible to remove a single bud for budding (chip budding with woody tissue inside maybe possible). Other grafting methods, such as bark grafting and whip/tongue grafting, are better choices for jujube propagation.

Jujube scions can be grafted onto jujube cultivar plants or suckers, cultivar seedlings, or sour jujube (*Ziziphus spinosa*) seedlings as rootstocks. Sour jujube seedlings as rootstocks are more popular than the others due to their wide availability, good germination, and stress tolerance.

Here is a list of basic supplies needed for grafting: a hand pruner to cut the rootstocks and scionwood, a sharp grafting knife to make the cuts on scionwood/rootstock, grafting tape to tie and cover the grafting union, labels, and grafting wax/seal (optional).

SEED PREPARATION

Sour jujube fruit should be collected or purchased in the fall. Clean the seeds by soaking the fruit in water for several hours, smashing the fruit, removing the pulp,

and repeating these steps until the seeds are clean. Keep the clean, dry seeds in paper bags until stratification (a process of pretreating seeds). Jujube seeds can germinate without stratification, but stratification makes germination easier and more reliable. Due to their hard kernels, seeds need to be soaked in water for three days before stratification, and the water should be changed once or twice per day.

After soaking for three days, mix the seeds with wet sand at a 1:3 to 1:4 ratio by volume. Depending on the quantity, store the seeds either in pots or plastic bags at 40 to 50°F for three months to complete the stratification process. If pots are used as stratification containers, make sure to add extra sand on top of the seed mixture to keep the mixture moist and check the moisture every 2 to 3 weeks. If plastic bags or zip-bags are used for stratification, leave openings for air circulation. As the soil temperature rises above 50°F, the stratified seeds can be seeded into a well-prepared field at a depth of 1 inch or so.

SEEDLING MANAGEMENT

Beginning when seedlings are 3 to 4 inches tall, fertilize them two to three times at 2-week intervals with a well-balanced fertilizer (10-10-10 or 24-8-16) at a total rate of 20 to 50 lb/acre nitrogen to enhance growth. Later in the growing season when the plants are 2 feet or so in height, pinch the growing tip with your fingers to stimulate trunk diameter growth and remove the lower branches to ease grafting. Depending on the location, some of the seedlings should be ready for grafting after one year of growth and all plants should be ready after two years.

SCIONWOOD

Due to jujube's unique shoot structure, good-quality jujube scionwood is not as readily found on the plants compared with apple or peach. Most of the side branches

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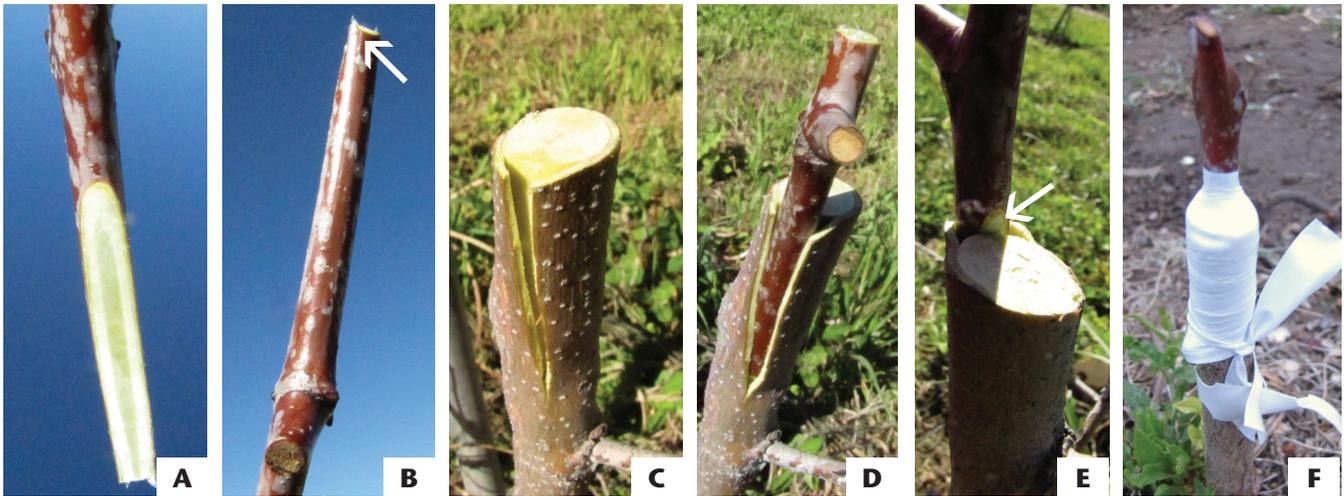


Figure 1. Bark grafting process: A. cut the scionwood; B. make a small cut on the back; C. make a vertical cut on the rootstock and loosen the bark on both sides of the cut; D. insert the scionwood into the open bark of the rootstock; E. leave some white area of the scionwood above the rootstock; F. tie and seal the graft union with grafting tape and label the plant.

are not thick enough to be used as scionwood, making the primary shoots the most often used scionwood source. With its long nodes, each primary shoot only has 5 to 8 nodes that can be used for grafting. Due to the lack of scionwood, a single jujube bud piece is often used for grafting, instead of 3 to 4 buds on apple or peach shoot pieces for bark grafting. One-year-old shoots are the best scionwood; however, two- or three-year-old shoots can also be used for grafting. Even though only a single bud is used for grafting, it is best to harvest scionwood in 12- to 15-inch pieces so that you have a larger stick to hold on to when grafting. Cut each piece to a single bud after the scionwood is cut and ready for inserting into the rootstock.

Scionwood Storage

If the scionwood is collected locally and will be used within 2 to 3 weeks, waxing is not necessary. If the scionwood is shipped from other places or will be used after a month or more, waxing the scionwood is recommended to keep the wood from drying out. You can use a tall candle jar to hold the wax and a double-boiler pot to prevent the temperature from rising above 212°F (100°C; water boiling point). Dip one end of the scionwood quickly into the wax and remove it as soon as you can, then repeat on the other end. Store the waxed or original scionwood (with some wet paper towels to keep them moist) in the refrigerator above freezing until grafting.

GRAFTING METHODS

Jujube wood is 2 to 3 times harder than apple and peach. A sharp knife is required for jujube grafting. Bark grafting is used for large-diameter rootstocks and small-diameter scions; whip grafting is used for smaller-diameter rootstocks. Bark grafting can only be done when the bark “slips” from the cambium during the growing season; whip grafting can be done in either the dormant or the growing season. By using a combination of bark and whip grafting, you will be able to use most of your available scionwood and rootstocks of varied sizes.

Bark Grafting

Bark grafting must be done during the growing season when the cambium layer is active and the bark is easily separated from the cambium (this is often referred to as being “slippery”). A few weeks after bud break is the best time for bark grafting. It can be done later in the growing season, but less vegetative growth will be obtained. With jujube’s thin bark and dense wood, several cuts are needed to expose a smooth, 1-inch or longer section of the scionwood’s surface (Figure 1A). A small cut on the backside is then made to expose the cambium layer (Figure 1B). Select a smooth surface close to the ground on the rootstock, remove the part above it with a horizontal cut, and make a vertical cut on the bark until you reach the cambium layer (a layer of cells between the bark and the wood) is exposed, and then loosen the bark on both sides and slide the scion into it (Figures 1C and 1D). Leave a small white area of the scionwood above the rootstock on the inner side for better healing (Figure 1E). Wrap and bind the graft union with grafting tape or a grafting band and make sure all the cut surfaces are covered

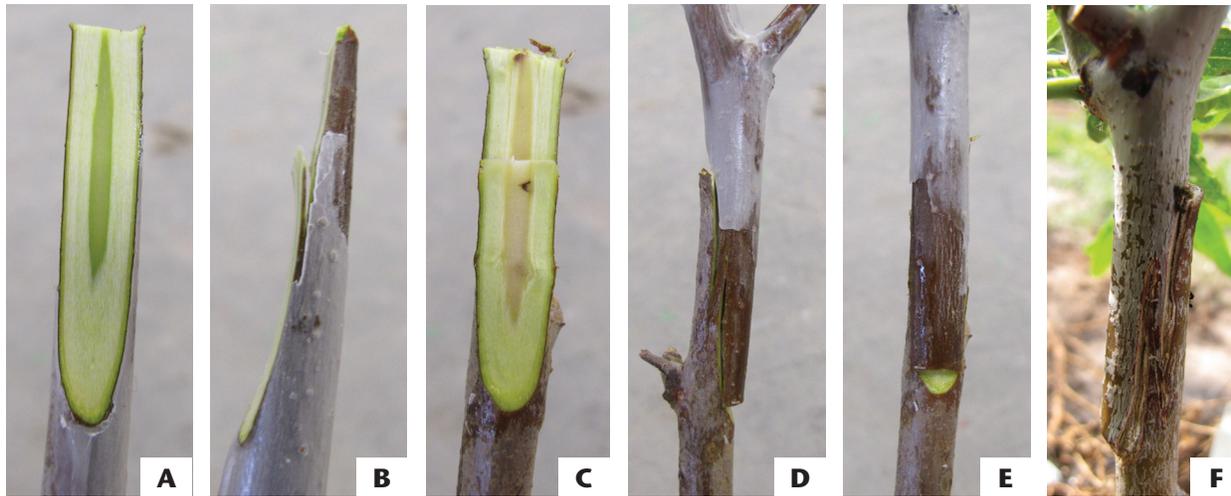


Figure 2. Whip grafting procedures: **A.** cut the scionwood to make a smooth surface; **B.** make a back cut at around 1/3 from the top; **C.** make similar cuts to the rootstock; **D.** place the scionwood cut onto the rootstock cut; **E.** front view of the graft; **F.** healed whip graft.

(Figure 1F). Make sure to wax/seal the top end of the scion with grafting wax/seal or cover it with grafting tape if you live in semiarid or arid areas like New Mexico. The last step is to label the plant with identifying cultivar and rootstock names or codes.

Whip Grafting

Whip grafting can be done both in the dormant season and the growing season. When whip grafting, the diameters of the scionwood and rootstock must match. Compared to bark grafting, whip grafting can utilize the smaller-sized rootstocks (1/4 to 3/8 inch in diameter); it is not practical for bigger rootstocks (>0.5 inch) because they are too difficult to cut properly. Whip grafting requires greater skill than bark grafting since the rootstock and scionwood need similar cuts—a smooth surface plus a back cut. However, the grafting union of whip grafting is stronger than bark grafting and avoids wind break. Figure 2 illustrates the basic steps of whip grafting. The wrapping and binding are similar to bark grafting, with all cut surfaces covered, including the end of the scion.

Management After Grafting

1. Support: When the new growth is 8 to 10 inches long, put a 4-foot bamboo stick into the ground close by and tie the new growth loosely to it to avoid breakage from high winds.
2. Remove rootstock suckers after grafting.

3. Water the grafted plants regularly and fertilize them twice when the scion is actively growing at 10 to 15 lb/acre N each time (2–3 week interval) with a balanced NPK fertilizer, depending on the soil.
4. Maintain a weed-free area around the plants through hand hoeing, herbicides, or weed barriers. If weed barrier is used, make sure there is a 1- to 2-inch space between the black fabric and the plant.
5. Cut the binding tape or rubber bands when the new growth is 4 to 6 inches long – just slit the binding and it will loosen and fall off after a few days.
6. Some cultivars can produce some fruit in the grafting year and all will produce some fruit at the second year after grafting.

Most jujube growers are discouraged by the limited number of cultivars available on the market. This guide mentioned the commonly used grafting methods for jujubes. With practice, growers can propagate their own jujube plants at home. Grafting is more art than science. Practice makes perfect. First-time grafters are encouraged to collect extra materials to practice on and to not get discouraged. You can also view a grafting video through this link: <http://www.youtube.com/watch?v=fFLwOWe0KQ4>



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