

Mechanized Grape Grafting

portable machine developed for bench or field grafting of grapes saves time and eliminates the need for skilled labor

C. J. Alley

Grape varieties established in areas having such pests as phylloxera or nematodes must be budded or grafted onto a suitable resistant rootstock.

In most grape-growing regions of California the usual method of propagation has been to bud the vinifera variety onto the rootstock best adapted to local climate and soil conditions. One year old rootings of the proper rootstock are planted in early spring and budded in late summer or early fall—August or September—just as soon as it is possible to obtain mature budwood and before the rootstock vines have stopped growth.

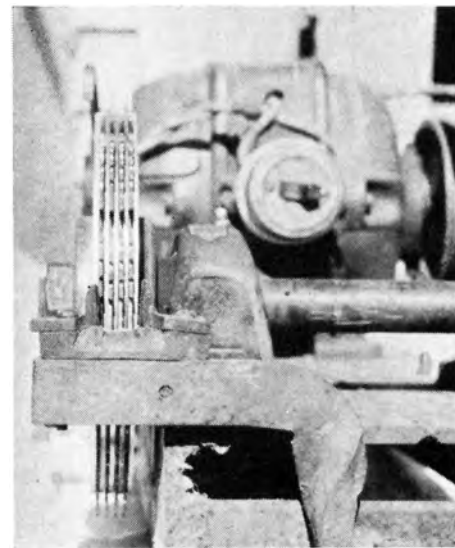
In shallow soils in nonirrigated regions, conditions often occur when the rootstock stops growing—because of lack of moisture—before the budwood of the desired variety is available. In such cases, the grower must resort to grafting in the spring.

Grafting has been done by hand but the current shortage of farm labor and the scarcity of skilled grafters and bud- ders make more apparent the need of a

machine for bench or field grafting rootings or cuttings.

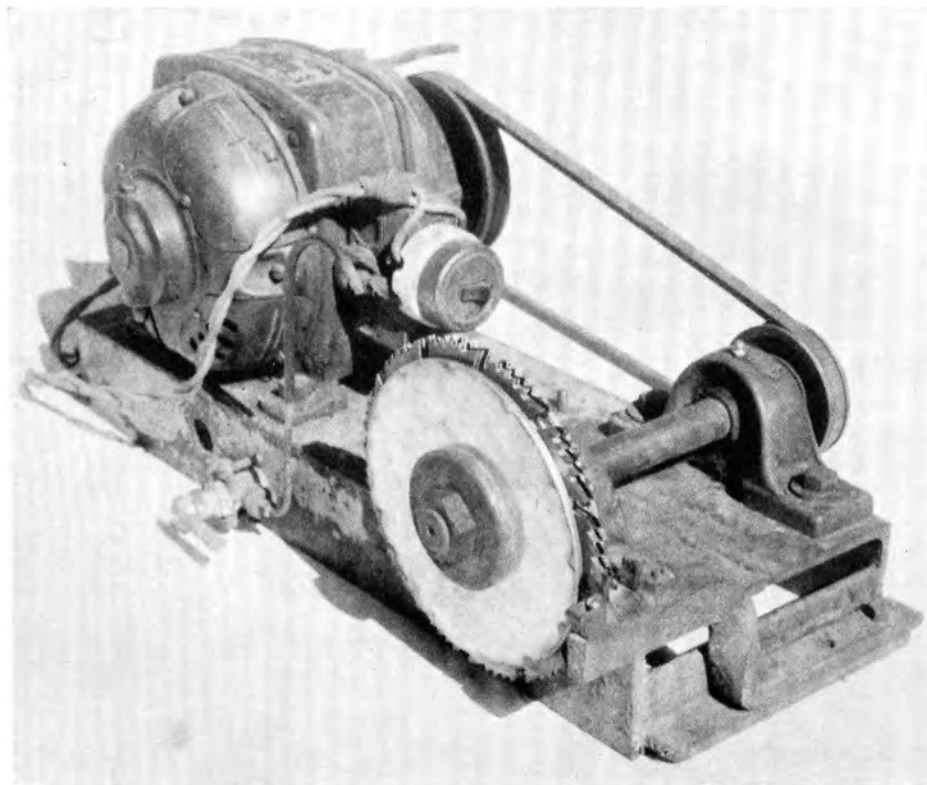
Such a grafting machine consists of a one-half horsepower 110-volt electric motor with a 5¼" pulley, that runs at 3,500 rpm. The motor drives a saw mandrel by a V belt at about 5,250 rpm. The saw mandrel is made up of a 3¼" pulley, a 1" shaft supported by two ballbearing supports, and the series of saw blades—separated by aluminum discs or spacers—all-purpose blades 1/16" thick and 8" in diameter with very little set to the teeth—1/32". Water is sprayed on the saw blades through the top of the saw guard with a 1/8" copper tube flared on the end to give a fine spray. This prevents burning or drying out grape tissue when cutting the series of tongues and grooves.

For bench grafting—scions and rootstock rootings or cuttings—the saw head consists of four blades each separated by an aluminum spacer. The spacers are 1/8" thick and 7" in diameter. The combination of blades and spacers is such that



Saw head with blades set for bench grafting cuttings or rootings up to ¾" diameter.

Bench grafting machine with saw cover and belt guard removed.



it cuts a series of tongues and grooves each 3/32" thick and 1/2" deep. The entire saw unit is covered with a sheet metal guard, except the cutting guide opening for the insertion of the scions and stocks, and the bottom which permits the water and sawdust to drain into a barrel. The cutting guides are adjusted so that when the rootstock cutting or rooting is cut against one guide and the scion against the other guide, a good fit between the rootstock and the scion is obtained, provided they are of the same size and the ends of both have been cut across squarely before the tongues and grooves are made on the machine. When scion and stock wood are 1/2"—or larger—in diameter, tying at the union with a rubber budding strip is unnecessary.

With the grafting machine three reasonably skilled men can make between 700–1,000 grafts an hour. Good, straight, well matured wood, accurately graded according to size is necessary for fastest work. In a number of carefully conducted tests the grafts made with the machine were comparable to short whip grafts made by hand by a skilled grafter.

The machine can be easily modified for the field grafting of vines too large to be field budded, or when changing over varieties. For field use, two saw discs are placed together with the two pairs of saws separated by a single alumi-

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MECHANIZATION

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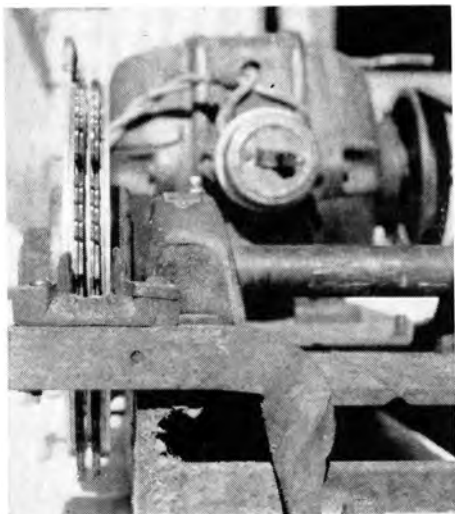
num spacer $\frac{1}{8}$ " thick and $6\frac{3}{4}$ " in diameter. The L-shaped cutting guide is adjusted so that the saws cut a single tongue in the center of the basal end of the scion. The tongue will be $\frac{5}{8}$ " long and $\frac{3}{32}$ " thick. When cutting the tongue the bud should face up or down, never on the side. By so doing the buds will be located either on the outside or inside of the scion when it is inserted in the stock. The lower bud should be positioned on the outside of the stock and as near to the graft union as possible.

Stock and scion notched—right—and fitted—left. Stock is about $\frac{3}{8}$ " diameter.



The second part of the field grafting procedure is made easier by the use of a hand saw that cuts a groove in the stock of the same thickness and depth as that of the tongue on the scion. Such a saw can be made from a 14" piece of saw

Saw blades arranged to cut a single tongue in scions.

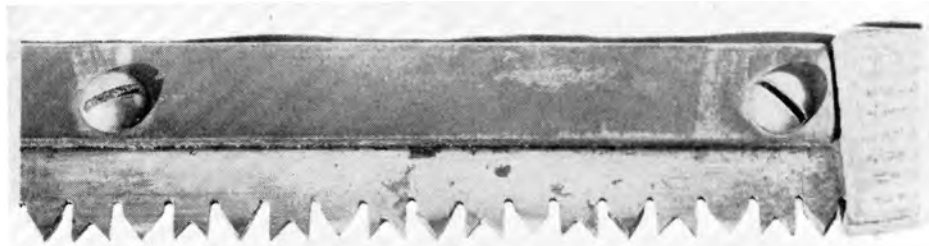


Hand saw for notching stock in field and scions having a single tongue.

steel $1\frac{1}{2}$ " wide and $\frac{3}{32}$ " thick. The blade of the saw should be about $10\frac{1}{4}$ " long with the remaining $3\frac{3}{4}$ " comprising the tongue of the handle. The teeth are made by starting at the tip and marking off intervals of $\frac{5}{16}$ " to where the handle begins. A hacksaw is used to make a cut $\frac{5}{16}$ " deep at each of the intervals. The tip tooth is a cutting tooth followed in succession by alternating drag and cutting teeth. The drag teeth are all alike but the cutting teeth alternate in angle of sharpening.

The point of the cutting tooth extends down nearly $\frac{6}{32}$ " of the total distance and is filed to a sharp point. The second tooth is a drag tooth. A groove is cut down the center of the second tooth $\frac{1}{8}$ ", then a V is cut to the base of the groove with the hacksaw. Each tooth is finished with a fine saw file to give two sharp

Detail view of hand saw showing tooth arrangement and shape.



points. The third tooth, a cutter tooth, is made the same as the first tooth except the bevel is filed on the opposite side from the first tooth. The handle of a suitable hardwood is from 4 "– $4\frac{1}{2}$ " long with a $\frac{3}{32}$ " slot cut down the center $\frac{2}{3}$ the length to hold the tongue of the blade.

The depth of cut can be adjusted with two guides—one on each side of the blade—consisting of hot rolled flat stock $\frac{3}{4}$ " \times $10\frac{1}{4}$ " fastened by three bolts or machine screws to the upper side of the saw blades. Adjustment is by movement of guides away or toward teeth by means of three slots—cut in the top side of the blade—corresponding to the location of the three bolts or machine screws in the guides.

The blade or tip portion—6"—of a

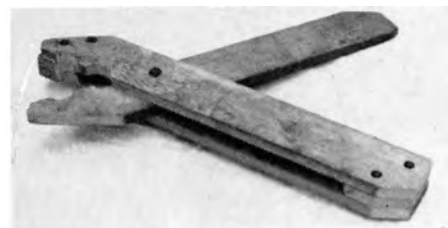
keyhole saw is attached to the top of one of the guides. When starting the cut into the trunk the keyhole blade is used to make a path for the main blade.

The scion should be placed carefully into the groove in the rootstock so the cambium region—the area exposed when the bark is pulled away from the wood—of the scion coincides with that of the stock. A common practice is to tap the scion in place at a slight angle to the stock with the scion slanting inward. The fit of tongue and groove should be firm so tying or nailing is unnecessary. The entire graft is covered with a mound of loose, moist soil.

Rootstock vines 2–4 years old are difficult to notch with the field saw unless held by one hand or by an assistant.

A good support for a one man operation is a rootstock vise made by placing two blocks 1 " \times 4 " \times 4 "—tail—and 1 " \times 4 " \times 6 "—head—at each end between two boards 1 " \times 4 " \times 25 " bolted together. A third board, 1 " \times 4 " \times 25 ", slides through the slot formed and is bolted 8" from the

Rootstock vise resembling a pair of pliers. Head shown at left.



head end forming a tool that resembles a large pair of pliers. Notches are cut in the head end of each board to accommodate the size rootstock being used. The head of the vise is placed around the trunk and pulled tight. Kneeling on the vise will give enough steadiness to permit the grafter to have both hands free to use the grafting saw.

Use of the grafting saw will not enable as perfect a fit as an experienced grafter can make, but the time required is much less and inexperienced labor can be used.

C. J. Alley is Assistant Specialist in Viticulture, University of California, Davis.

The grafting machine described in the above article is a modification of one designed by H. E. Jacobs when Associate Viticulturist, University of California, Davis.