

BRUCE BRIGGS: Is Dr. Harris here from Victoria, B.C.? He has been working on grapes; last year he ran about half of his grape cultivars through tissue culture and repeating the process, he felt at that time they were free of those viruses that he could identify. It would be interesting to see whether we can do this with all woody tissue, but it was done on grapes — and it is promising.

KIWIFRUIT PRODUCTION

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INTRODUCTION

Of all the recently introduced subtropical crops, none has caught fire like the kiwifruit or Chinese gooseberry, *Actinidia chinensis*. Not an old warmed-over crop, or one that's been hidden in the corner, this one is a real newcomer. Since its commercial introduction by New Zealand, it has been grown commercially in the Western and Eastern United States, other American countries, Israel, Greece, Italy, France, South Africa, and Japan.

Actinidia chinensis is native to borders of the Yangtze Valley of China where it is not subject to serious frosts, but receives enough winter chill to stimulate profuse blossoms. The wild plant of these regions is a large vine that may climb to a height of 30 feet (10 m). Until recently, its popular name was *Chinese Gooseberry*.

The *Chinese Gooseberry* was brought to New Zealand about 1900, and planted as a curiosity. It remained in obscurity for years, until the New Zealanders developed certain prolific cultivars which bore abundant, highly edible fruit. The most famous of these, and the current standard, is the 'Hayward.' By the 1960's, New Zealand growers exported Chinese gooseberry fruit to the United States. About 1974 they adopted the name "kiwifruit" — presumably because of the brown hairy exterior, reminiscent of their native national bird, the kiwi.

The United States received its first pair of kiwifruit plants from New Zealand in 1935, they were planted at the USDA Plant Introduction Station at Chico, California.

The Tanimoto Brothers of Gridley first propagated kiwifruit commercially in 1964. They had heard of imported Chinese

gooseberries selling in San Francisco for \$1.50 per pound. Conversation with their University of California Farm Advisor led them to horticulturist Bob Smith, at the USDA Chico Station, who furnished them with advice and propagation materials from the "mother vine" at Chico and from the Chico male vine. Fortunately both Chico vines turned out to be superior and complementary cultivars for commercial production in the Sacramento Valley. The mother vine cultivar is now known as Chico Hayward.

VINES AND FRUIT

Kiwifruit vines are vigorous and large. Single vines can become the size of large orange trees. Their dark green leaves are roundish, flat, and 10 to 12 inches across. The plants are divided into sexes (the species is dioecious) so that male plants are staminate fertile; female plants are pistillate fertile. Normally only female plants bear fruit, though hermaphroditism has been reported.

Usually deciduous, the kiwifruit vine sometimes fails to complete dormancy in certain warm winter locations. If winter chilling is insufficient, leaves may become tattered and burned at the margins, and remain attached to the plants for long periods.

Climatic limitations for the kiwifruit are not stringent. Fine kiwifruit growing areas in California include the Central Valley, the hills around Ramona in the South and Red Bluff area in the North. These areas are normally free from severe freezes either during March, April, and May when kiwifruit vines are producing spring shoots and flowers, or during October and November when the vines are carrying unharvested fruit. Yet, these areas are cool enough to fulfill the chilling requirements. Nobody really knows precisely what are the chilling requirements. We only know that the Central Valley normally provides correct conditions for the most popular cultivars, whereas the balmy coastal regions of Southern California do not.

Lack of frequent strong winds seems to be another requirement for kiwifruit culture. An abundance of high quality water must be available for proper growth since the kiwifruit's shallow, fibrous root system has become adapted to heavy rainfall areas. It is essential that sufficiently extensive ground areas be frequently and abundantly watered and that the soil have efficient internal drainage qualities.

Kiwifruit vineyards are not troubled by many serious pests. Occasionally, though, they are visited by scales and moth larvae. Crown rot is sometimes a problem when high temperatures and wet soil coincide. Crown rot in young vineyard plants has been attributed both to *Phytophthora* and *Rhizoctonia* species.

The most popular cultivars have fruits about the size of

goose eggs, with stiff hairs about 1/16" long extending outward from the brown skin on all surfaces. The interior flesh is bright green in color, translucent, and dotted with hundreds of tiny, dark, edible seeds. Its flavor has been compared to that of the strawberry, pineapple, melon, guava, and so on. Fresh fruit may be stored at 6°C (43°F) for at least six months. Kiwifruits are useable in many ways. The fruits can be peeled and eaten out of hand, or served as slices in salads and in fruit desserts. They may be frozen or canned. They make tasty preserves or jam. Additionally, a thoroughly acceptable kiwi wine is now on the market.

VINEYARDS

Commercial kiwifruit vines are large and bear heavy loads of fruit requiring the support of a very sturdy trellis system. Generally trellises are of the "T"-bar type, most commonly constructed of vertical members of lodgepole pine, 5"-6" in diameter, that rise to 6 or more feet above the ground. Crossarms are 6 feet long and horizontally mounted at the top of the vertical member. These trellises are braced and set at 20 foot intervals in rows that are about 15 feet apart from center to center. Five wires are stretched tightly on the crossarms of the trellises from the ends of the rows. A kiwifruit vine is planted by each trellis.

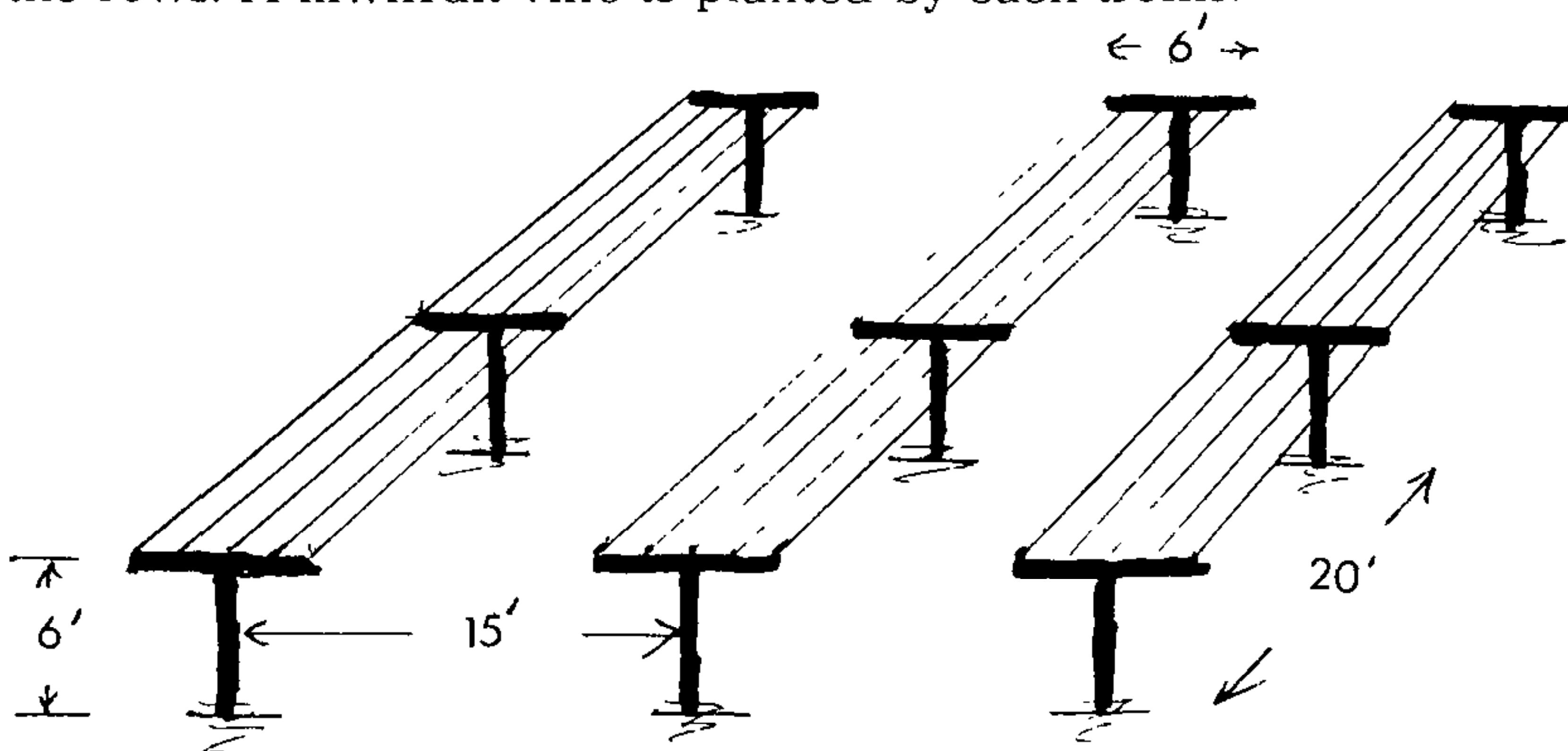


Figure 1. Diagram of typical five-wire T-bar trellis system used for kiwifruit

Female plants outnumber male plants eight to one in most commercial plantings. There is no sacred ratio but one male to eight females is standard practice.

The most time consuming operation in any vineyard is pruning. Each winter, growth is cut back allowing fruiting wood to remain for the following spring. In addition, summer pruning is performed to provide proper illumination of the vine's interior.

PROPAGATION

California commercial propagation has a history of only 15

years, and the methodology is in a state of flux. Most propagation has been for the purpose of providing vines for commercial plantings.

California kiwifruit vines are normally grown either as grafted seedlings or rooted cuttings. Grafting of seedlings is the most popular method as it is easy and dependable.

Grafting of seedlings

Raising the seedlings: At Brokaw Nursery, Inc. we normally sow the tiny kiwi fruit seeds (about 1 teaspoon per flat) in the hothouse during January, February, or March. The seeds have been previously extracted from commercial fruit of any standard cultivar. Extraction is done by hand, which is very laborious, or by machination of the fruit in a blender and subsequent separation from the pulp through a strainer. The equivalent of stratification may be accomplished either by: (a) layering the seeds in damp sand in a refrigerator for three weeks, or (b) leaving the surface-dried seeds in plastic bags, removing them from the refrigerator during each day and returning them each night for a period of three weeks. These "stratification" procedures are for the purpose of breaking dormancy, a condition which often afflicts the kiwifruit seeds soon after they are extracted from the fruit.

About a month after sowing, the young kiwifruit plants are growing thickly. A few will be ready to transplant bare root, into small pots. We normally plant them either into Jiffy #7's or into small plastic bags filled with a peat-perlite blend. After the plants in Jiffy #7's have established roots, we transplant them outside into three gallon plastic containers for later grafting. Sometimes we hold the small seedlings planted in the bags and graft them in the greenhouse.

Grafting — (inside the greenhouse in small plastic bags): I understand that some nurserymen "green-graft", which is grafting scions onto green succulent seedlings in the hothouse. Personally, I have not succeeded with this method. We graft by using a whip- or wedge graft after the main seedling stem has matured and hardened. For this, we use dormant, or firm green, scion wood. After the scions have knitted and grown to a five or six inch length, the young grafted plants may be transplanted into larger containers.

Grafting — (outside in three-gallon container): Plants that have been transplanted into large containers (1 gallon or more) in the spring may be whip- or wedge- grafted, or budded the following September or October, or the next April or May. Fall grafting may be accomplished either with dormant scions from the prior winter or with firm green fall budwood. For spring

budding one may use dormant buds stored from winter gatherings.

Sometimes nurserymen graft during winter, using dormant scions. If one does this, it is wise to use local scion sources only, as it is essential that the grafted scions do not break dormancy before the rootstocks do or before the callusing (healing) process is under way.

Grafted seedlings make fine plants and are preferred by many vineyard owners. They have two possible deficiencies: (a) uncontrolled rootstock shoots may outgrow the scions; and (b) in case of a strong freeze the plant may be frozen to the ground, thus killing the wood to a point below the graft union. In the latter case, subsequent regrowth of the rootstock can be regrafted with new scion wood.

Rooted cuttings

There is a common opinion that New Zealand nurserymen find it very fast and efficient to root cuttings, but believe that the more troublesome grafted seedlings are superior.

Both hardwood and softwood cuttings have been attempted in California. While there are a few reported successes with winter hardwood cuttings, most positive results have been with fairly young spring, summer, and fall softwood cuttings. One, two, and three-noded cuttings have been used, with a single leaf (often trimmed) attached to the upper node. Mist may be applied. Hormone dips (IBA at 6000 ppm is standard) are normally applied.

A common problem with the rooting of cuttings is that the foliage buds often precede the emergence of roots. The ever-abundant callus tissue is said to inhibit root initiation. Perhaps this could be controlled by heating the rooting medium while retaining a chill in the moistened atmosphere above the rooting medium.

Another problem seems to be that the leaves are prone to abscise before the buds sprout. The cuttings then act as if they are going into dormancy.

Some growers report that the root systems of cuttings are inferior to those of seedling rooted plants. However, the few cuttings that we've grown at Brokaw Nursery, Inc., seem to have satisfactory root systems.

GROWING THE PROPAGATED PLANTS

At Brokaw Nursery, Inc., we sell a grafted plant that is about 15 months from seed. It consists of a single long vertical shoot, five feet long, with a leaf at each node, trained to a stake. Its caliper is about 1/2 inch.

The most troublesome part of growing such a plant is the training of the scion to climb straight up its own stake. Being a vine, the fast growing tip forever seeks neighboring stakes and winds around them. Therefore, one has to be always correcting the vine with training ties of some sort. Further, before the vine reaches the top of its stake, it often slows its growing so that the tip begins to twist and "corkscrew". When this happens, a common remedy is to cut the leaders back to pencil-thick wood. In three or four weeks, a strong axillary bud will assume the function of the former growing tip.

TIMING FOR VINEYARD PLANTING

Since kiwifruit plants are deciduous, many excellent vines are delivered bareroot. They are grown in nursery rows, dug during the winter, and planted during the winter or spring. They may be stored for a time under refrigerated conditions.

Containerized plants, such as ours at Brokaw Nursery, may be planted at any time during the year. Kiwifruit plants are precocious and vines that are planted in October may bear a few mature fruit one year later.

THE POTENTIAL FOR GARDEN KIWIS

Kiwifruit vines are popular among homeowners because of their novelty and the fact that nearly everyone likes the fruit the first time he tries it. The vines are attractive but must be provided with robust support and ample space. Some people design arbor systems, which can be utilized for shade in the summer and provide an open latticework protection during the winter.

I have not yet seen anyone espalier kiwifruit though it seems possible.

Incidentally, young kiwifruit plants are attractive ornaments indoors. A few years ago we produced "Kiwi Pairs" (male and female) in an attractive six inch pot. They were sold as an item to grace the interior of the house temporarily, and later to be transplanted outside. Though very attractive and popular, they had a survival problem. The indoor plants were exceedingly tender when transferred out of doors, and home gardeners consistently lost them.

CULTIVARS

Two commercial cultivars are standard in California, the 'Hayward' and the 'Chico Hayward'. They produce abundant crops of ovoid fruit. Both cultivars have a fine flavor and produce good sizes (3 to 5 oz.) in most California districts.

Some of Southern California's coastal districts provide too

little chilling for these standard cultivars and in these areas it is best to use one of the following alternatives:

'Bruno' — this is a New Zealand cultivar with somewhat smaller fruit of a long narrow shape. The vine is quite prolific.

'Vincent' — This cultivar is from a seedling of Fred Vincent, propagator in balmy Yorba Linda. The abundant fruit, somewhat smaller than 'Hayward,' has been very acceptable to Mr. Vincent's local customers.

Two male cultivars are in common use in California. They are 'Chico Male' and 'Matua.' While there has been some complaint about their blossoming periods, both seem to be more than satisfactory under most commercial conditions in California.

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MINIATURE ROSE PRODUCTION

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The propagation and sale of miniature rose plants has been our business at Sequoia Nursery for many years. During these years many changes have taken place, as has happened throughout the nursery industry. First of all has been the phenomenal increase in popularity of the miniature rose.

Beginning with miniatures in a small way, as a side line to our general nursery some forty years ago, we changed to the production of miniatures exclusively about 23 years ago. Since then our production has increased to the point where we now grow some 600,000 to 700,000 plants annually.