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Growing Grapes in Hawai‘i

Ken Love[1] **and Robert E. Paull**[2]
[1]Hawaii Tropical Fruit Growers Association;
[2]Tropical Plant and Soil Sciences, University of Hawai‘i at Manoa

Introduction and Early History

Thousands of years of observations and hundreds of years of research are reflected in the hundreds of thousands of pages that have been written on viticulture, or grape growing. This information is available in books, research articles, and extension publications that can be found online and off. The intent of this publication is to provide growers in Hawai‘i with the background of grapes in the tropics and the very basics of growing grapes.

Early archeological remains suggest winemaking was prevalent in the region of Georgia 8,000 years ago, and the remains of an Armenian winery date back to 4000 BC. Grapes and wine were enjoyed in Persia, especially in the city of Shiraz, which may have produced the first Syrah (or Shiraz), a dark-skinned grape variety. Phoenicians also enjoyed both wine and fresh grapes. More than 100 grape varieties have been genetically mapped in the Mediterranean area. Egyptian hieroglyphics record purple grapes being enjoyed as a fresh fruit and made into wine. The Greeks' 6,000-year-old wine culture revolved around, Dionysus, the son of Zeus and Semele, who was the god of the grape harvest, winemaking, and wine. Dionysus is also known as Bacchus, the name adopted by the Romans. The Greeks are known for their "symposia," intellectual gatherings where participants discussed philosophy while enjoying wines from eight growing regions. "Modern"-style wine presses are found in tombs from 3000 BC, and in the Minoan village of Myrtos, wine cups, amphorae, and grape seeds were found. Other vessels have been found in the ruins of the storage houses of King Minos' palace in Knossos.

Scientific Names
Family Name: Vitaceae
Genus: Vitis L.

Common Names
Grape (English), uvae (Latin), uva (Portuguese, Italian, Spanish), raisin (French), ubas (Tagalog), trauben (German), uzum (Turkish), budou (Japanese), szolo (Hungarian), hardhi (Albanian), strugure (Romanian), stafyli (Greek).

Viticulture flourished in the Byzantine Empire from the fifth century through its fall in 1453 to the Turkish Ottoman Empire, and it continues in the region to this day. Grapes are grown throughout the Mediterranean Basin for their fruit and leaves and to make wine. Stuffed fresh grape leaves, called "dolma," from the Turkish "to stuff," were said to have been served to Zeus with ambrosia and nectar. Dolma are now made with rice, meat, spices, and vegetables such as tomato, pepper, onion, zucchini, eggplant, and garlic. Like the fruit, the fresh leaves of the grape vine have been continuously used throughout culinary history.

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History in Hawai‘i

The earliest review of grapes in Hawai‘i was made by Harold St. John, professor of botany at the University of Hawai‘i from 1929 to 1958. St. John felt the first grape vines might have come with Captain Vancouver in 1792, although there is also speculation that they came with Don Francisco de Paula Marin in 1791. Warren Yee, a specialist in horticulture with the University, suggested that the ‘Isabella’ grape came with early Portuguese immigrants later in the 1800s. Current Baldwin family members have said the ‘Isabella’ grapes are thought to have been planted at the Lahaina Maui Baldwin House in the 1850’s, where they continue to flourish. In a journal entry of February 1796, Lieutenant William Robert Broughton, sailing with Captain Vancouver’s expedition to the North Pacific, says he brought and planted grapes in Kealakekua. When he returned in July of the same year, they had all disappeared.

In Honolulu, Marin’s vines had taken root by May 25, 1814. On September 6, 1815, Marin in his diary referred to his “new vineyard,” although most references are to the “Kings vines.” Marin had asked Kamehameha to put a kapu or taboo on the planting to prevent pilferage. The vineyard remained at the site across from the current Foster Botanical Garden for a number of decades. A description written in 1822 said, “The vines…trained after the Spanish fashion in bushes, flourish luxuriantly. The proprietor tells us that they would bear three crops in the year, though he prudently prevents the third lest it should too much exhaust the stocks.”

On April 17, 1815, Marin wrote of the “great havoc in the vines committed by Captain Winship’s hogs,” and on May 31, he complained that “many branches of grapes have been carried off.” Enough must have remained that on July 6 Marin was able to write, “This day I began to make wine and I drew off 38 gallons.”

In 1825, the ship *Blonde* arrived with the bodies of King Kamehameha II and Queen Kamāmalu, who had died in England. On board was James Macrae from the Royal Horticultural Society and the naturalist Andrew Bloxam. They brought a large selection of plants, including grapes from England, Madeira, Rio de Janeiro, and Valparaíso, Chile. The vines were labeled ‘Valparaiso’, but it was unclear if they were *V. vinifera*, the variety now called ‘Valparaiso’. The vines were turned over to Marin, who planted them on May 28 and July 7 of 1825. By 1831, Marin’s vine-

yards were well established in Honolulu. By 1826, his wine production had climbed to 1,330 gallons, mostly distilled as brandy.

In 1899 the Gomes-Serrao family had 80 acres of what were reported to be ‘Isabella’ grapes in Pāpa‘ikou, north of Hilo, in the same area where the Hawaii Tropical Botanical Garden is located. The vines were grown from cuttings that Jose Gomes-Serrao had brought to Hawai‘i from Madeira in 1883. By 1903, wine was being made and sold from this vineyard.

Throughout these accounts of early grapes in Hawai‘i, there is continuing speculation as to their parentage. While much early reference material refers to them as ‘Isabella’, or *Vitis* x *Labruscana*, this is speculation, as they might have been *V. vinifera* or *V. labrusca*. Most grapes are cultivars of *V. vinifera*, native to the Mediterranean and Central Asia, while *V. labrusca* is native to the Eastern United States and Canada. Grapes are wind-pollinated, with flowers containing both male and female parts (hermaphrodites). Most *Vitis* species are closely related, and fertile hybrids are common. The ‘Isabella’ grape stock being grown today in Hawai‘i comes from the USDA Gerplasm Repository at Davis, California.

Origin, Varieties, and Cultivars

In the 1940’s, tropical grapes were touted as a “new class of fruits.” *V. tiliaefolia, V. gigas*, and *V. shuttleworthii* occur naturally in tropical and sub-topical areas. Many of these were thought to be more disease resistant than ‘Isabella’ and other varieties that had previously been grown in Hawai‘i and in other tropical locations. A number of crosses between *V. vinifera* and *V. labrusca* showed promise but apparently were never fully successful in Hawai‘i. Some newer hybrids are currently under test in the state by members of the Hawaii Tropical Fruit Growers Association.

India produces over one million tons of grapes in the tropics. Commercial grapes are also produced in tropical areas in Brazil, Colombia, Mexico, Thailand, Tanzania, Yemen, Peru, Saudi Arabia, and Venezuela.

There are over 10,000 types of grapes described worldwide from more than 25 species and subspecies. Most of these are edible, but the majority of popular grapes fall into one of five species:

V. vinifera

The most common grape, originally from the Mediterranean and Central Asia, is used primarily for wine, with

some eaten fresh out of hand. Common varieties read like a wine list: ‘Petite Sirah’, ‘Cabernet’, ‘Merlot’, ‘Muscat’, ‘Pinot Noir’, and many hundreds of others. Other table grapes include ‘Thompson Seedless’, ‘Sultana’, ‘Red Flame’, ‘Black Rose’, and ‘Koshu’.

V. labrusca
North American in origin, a few of the more common varieties include ‘Isabella’, ‘Concord’, ‘Niagara’, ‘Ruby Seedless’, ‘Crimson Seedless’, ‘Orlando Seedless’, and ‘Catawba’. ‘Isabella’ is most likely a cross with an unknown *Vitis vinifera* and was widely imported into Europe in the early 19th century, possibly carrying the disease *phylloxera*, to which it is resistant.

V. riparia
This species is primarily used for rootstock and in breeding because of its cold-hardiness and disease resistance.

V. rotundifolia
This is perhaps one of the most important species for Hawai‘i. This grape is native to the Southern United States and includes ‘Muscadine’, ‘Scuppernong’, ‘Jumbo’, ‘Black Beauty’, ‘Big Red’, and ‘Supreme’.

V. amurensis
V. amurensis and its sub-species are native to the Amur valley in Russia and China and are popular in Russia, Hokkaido, and other northern growing areas. They do not perform well in dry areas but are fairly resistant to diseases. A few varietal names are ‘Black North’, ‘Russian Concorde’, and ‘Kurinka Russkaja’.

Other species include *V. andersonii, V. arizonica, V. blancoi, V. californica, V. flexuosa, V. hui, V. mengziensis, V. palmata, V. rupestris, V. shuttleworthii, V. vulpina*, and *V. yunnanensis*.

Varieties for Hawai‘i

History tells us that ‘Isabella’ types of grapes have done well and should continue to be grown in Hawai‘i. Many new pests and diseases that might affect the vine were not present until the mid-1900s but are now in the state. *V. rotundifolia* includes a number of varieties, such as ‘Southern Home’, that have been sold in stores around the state. Some success has been reported with these at 460-meter (1,500-foot) elevation.

Some varieties that currently produce in Hawai‘i below 610-meter (2,000-foot) elevation are ‘Isabella’, ‘Southern Home’, ‘Crimson’, and ‘Orlando Seedless’.

Other cultivars that currently grow in tropical areas are primarily crosses between *V. vinifera*, *V. labrusca*, and *V. rotundifolia*. They include ‘White Malaga’, ‘Alphonse Lavallee’, ‘Cardinal’, ‘Kyoho’, and ‘Perlee’, all of which are grown in Thailand, along with ‘Isabella’. In Bali, Indonesia, ‘Probolinggo Biru-81’, ‘Banjersari 45’, and ‘Banjersari 56’ are the most popular. ‘Centennial’, ‘Summer Muscat’, ‘Diamond Muscat’, and ‘Princess’ also show promise; they are currently being grown in Honolulu and are under test in Kona.

Empresa Brasileira de Pesquisa Agropecuária, the Brazilian Agricultural Research Corporation, known as EMBRAPA, has released seven new crossed-species hybrid cultivars for the tropics at their National Center for Research on Grape and Wine (CNPUV). These include table grapes ‘BRS Morena’, ‘BRS Clara’, and ‘BRS Linda’; wine grapes ‘Embrapa 131’ and ‘BRS Lorena’; and juice grapes ‘BRS Cora’ and ‘BRS Violeta’ (see Table 1).

Time and effort will be needed for researchers and farmers to choose from this list the best types of grapes

‘Isabella’ has historically been one of the most successful cultivars in Hawai‘i.

Table 1. Grapes from the USDA recommended varieties and cultivars list that are being tested in multiple Hawaiian locations or have tests planned.

Name	USDA Accession Number	Name	USDA Accession Number
‘Niabell’	113	‘Joannes-seyve 12-426’ (J.S.)	198
‘Niagara Rosada’ (classic Labrusca)	1111	‘Excelsior White’	298
‘Hayes’	66	‘Joannes-seyve 18-875’ (J.S.)	202
‘Wyoming’	162	‘NY33873’	1328
‘Hicks’	69	‘Carolina Black Rose’	2540
‘Lady’	87	‘15b-13’	2714
‘Chowan’	1745	‘Seminole’	2726
‘Lasalle’	1753	‘Lakemont’	1324
‘Dixie Red’	1763	‘Flala cn1-90’	2572
‘Tara’	2439	‘NY 32042’	1336
‘Jumbo’	1765	‘Orlando Seedless’	2710
‘Everglade f272’	2581	‘Fla a4-23’	2713
‘Golden Queen’	412	‘Tamiami’	166
‘Midsouth’	2105	‘Fla an2-36’	2567
‘Hybrid Requa’	123	‘Dunstan340’	2590
‘Zhender 70-81’	3226	‘Aurelia’	2695
‘Remaily U#57’ (lady finger)	3564	‘Caribe’	2474
‘Zhender 00-15-3’	3489	‘Dunstan’ x dxr 73-26 rotundifolia	2711
‘M39-9/74’	3279	‘Fla cb8-1’	2583
‘Burmunk’	3289	‘Koshu Sanjaku’	84
‘Toldi c 50’	3286	‘Koshu’	82
‘Fresno USDA’	3241	‘Senator’	141
‘Tom Cord’ (seedless ‘Concord’)	3342	‘Pocklington’	3221
‘Uzbekistan Muskat’	2072	‘Early Green’	64
‘Bianca Nieves’	3085	‘More Oakland’	107
‘Dunstan 345’	3089	‘Golden Giant’	63
‘Dunstan 337’	3088	‘Meridian’	2624
‘Zhender 88-3-12’	3237	‘Bergaw’	2628
‘Izunishiki’	3166	‘Joannes-seyve 12-462’	199
‘Seibel 4614’	304	‘Seibel 6968’	258
‘Seibel 2838’	2148		

Hardwood cutting (above) vs. green wood cutting (below).

Cuttings after one week.

to grow in Hawai‘i, with its great range of microclimates. Growers can, with local commodity groups such as the Hawaii Tropical Fruit Growers (HTFG), order cuttings from the USDA germplasm depository at UC Davis for testing. http://www.ars.usda.gov/Main/docs.htm?docid=12254.

Environment

Grapes prefer well-drained soil, making many Hawaiian locations ideal. Highly fertile soils are not required, as they frequently promote excessive vegetative vine growth. The ideal soil has a pH just below 7. The soil should be kept weed free and in fallow for a period prior to planting in order to reduce potential pest populations.

Temperatures between 25 to 30°C (77 to 86°F) are optimal for shoot and fruit growth. Full sun exposure is needed, though direct sun exposure onto fruit is to be avoided. (See section on trellises.)

Irrigation

Grapes need about 19 liters (5 gallons) per vine at planting. They later need 11 to 19 liters (3 to 5 gallons) of water per vine per week from rainfall and irrigation. Soil moisture levels should be about 70% of field capacity. Drip emitters should be as close to the root ball as possible, especially on new plantings, to ensure maximum water use efficiency.

Vineyard Establishment

Propagation

Most grapes are propagated vegetatively from either green but mature wood or from dormant hardwood. Dormant hardwood cuttings at least one centimeter in diameter (~0.5 inch) are preferred. The length can be 30 to 45 cm (12 to 18 inches), although in some regions, shorter pieces are used depending on the species and length between the nodes. A cutting with at least two nodes is needed, with the cut made 4 cm (1.5 inches) above or below the nodes. There need to be 1 or 2 nodes in the potting mix and 1 or 2 above. Cuttings need to be kept damp and in high-humidity conditions before planting to prevent excessive drying.

Green wood cuttings can also be used for propagation. The cutting should be taken from below about 12.5

Trellising system.

Classic arbor.

cm (5 inches) from the green tip. The green tip should be cut off and discarded. Green cuttings below 12.5 cm (5 inches) can be used for planting. The USDA recommends that cuttings should be shorter than hardwood cuttings and contain 2 or 3 nodes. The bottom should be cut just below a node and the top should retain part of a leaf. Other leaves should be removed. Green wood cuttings do best in a mist bed with a mix of perlite and vermiculite. Depending on the species, they can take from 2 weeks to 2 months to root.

Trellises and Arbors

Many types of trellises are used in different grape-growing regions of the world. In the tropics, it is generally recommended that the type of trellis used maximize the support for vine and foliage in order to shield grapes from sun damage. Classic arbors work well for this purpose. Other trellises should have T-supports, usually no more than 8.5 m (28 feet) apart, with high-tensile 12.5-gauge galvanized wire between them. A 14-gauge wire can be used for training the stalks. In Japan, with the popular Kyoho grape, no more than 50 vines per hectare are planted.

The grapes Marin grew in the early 1800’s were said to be grown in the Spanish style, meaning each plant became a small shrub and supported itself. Arbors and trellises later became popular and helped increase production.

Culture and Management

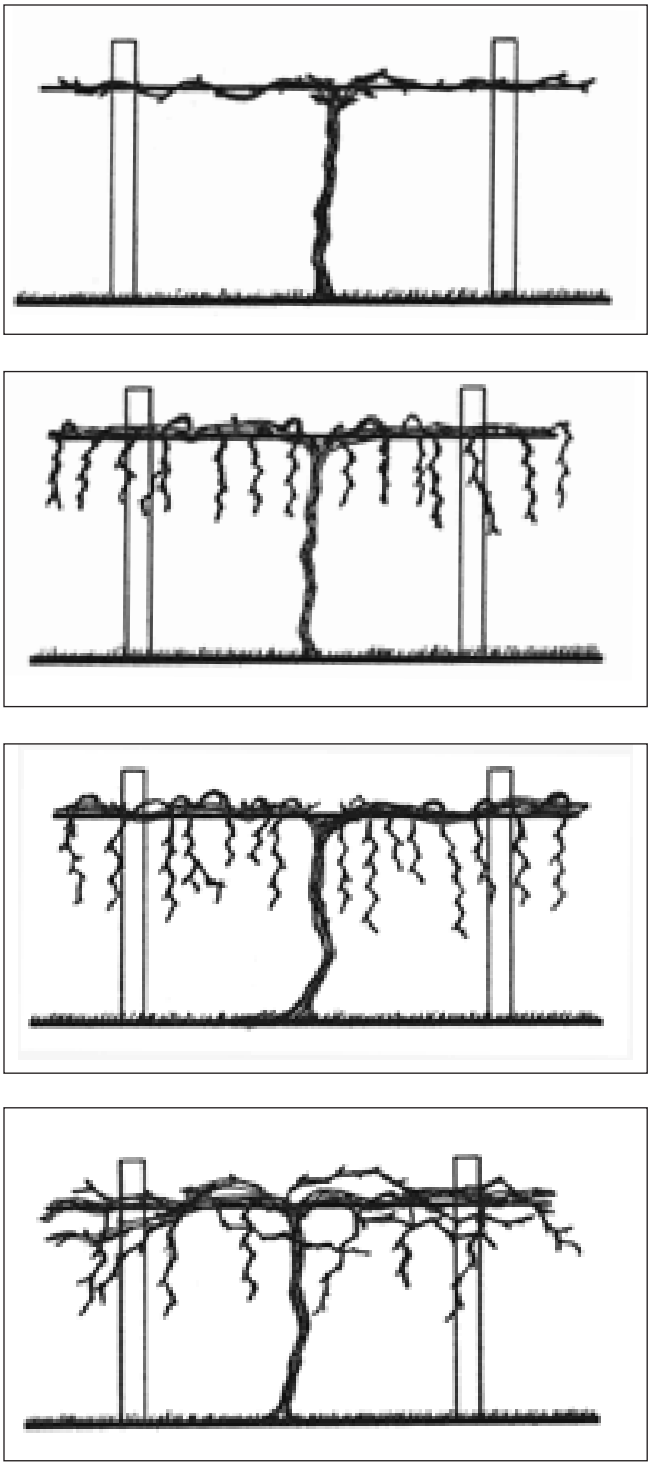
Vine spacing is usually determined by cultivar, with rows 2 to 3 meters (7 to 10 feet) apart being the most common. The space between rows or trellises is at least 2 meters (7 feet) or wider, depending upon whether machinery access is required. After the first year of growth, less vigorous shoots are cut off and training begins. Proper training of new growth is essential to maintain production and the needed balance between fruit and vegetation growth.

On established vines, between 75% and 90% of the previous year’s growth is removed. Much depends on the particular cultivar and location. Generally two trunks are kept in order to maximize production area for each vine. Maximizing the production of each vine helps to produce more bunches of grapes. Bunches should be thinned considerably so as to producer larger, higher-quality fruit.

Pruning and Training

Vines are pruned, first to control the size and style of the vine, then to balance flowering, fruit, and vegetative growth. Training is necessary to maximize sunlight entry into the canopy and productivity. Vines are also trained and pruned to facilitate harvesting. Many varieties respond better to specific pruning and training styles, indicating that research is needed to determine what system works for each variety.

A pruning guide for backyard growers can be found at http://ohioline.osu.edu/hyg-fact/1000/pdf/1428.pdf. This guide, from the University of Ohio, describes a number of training options. The most important thing to remember is that in Hawai‘i, we need to protect the grape bunches from excessive sunburn. In Japan and other Asian locations grapes are grown in bags to slow

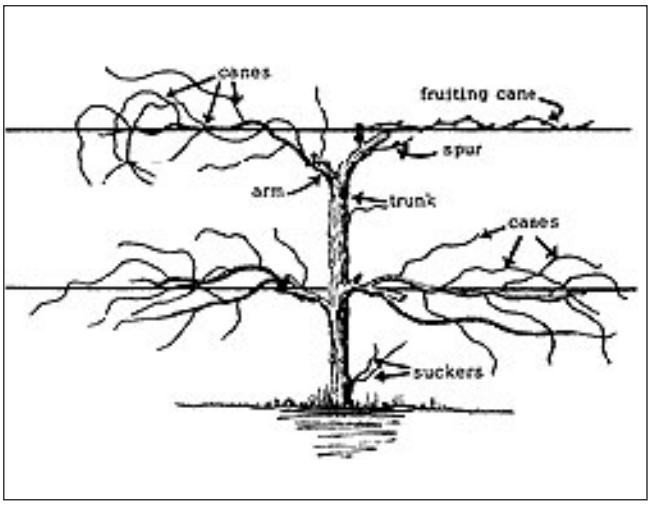


Top to bottom: (a) Head-trained system, (b) bilateral high-cordon system, (c) shoot-positioned grapevines, and (d) non-shoot positioned grapevines. Source: Brown, M., G. Gao (2004).

the ripening process (verasion) and protect them from sunburn and birds. Plastic covers above the vines are also used to protect the vines from rainfall and reduce disease.

Methods for Dormancy Induction in the Tropics

The high disease pressure and the lack of cold (chill requirement) are the two major factors limiting grape production in the tropics. Often, only 3 to 4 weeks of cool weather satisfies the chill requirements of selected varieties, to induce growth dormancy and subsequent flowering. In temperate zones, it is usually the winter cold that induces vines into dormancy. Rainfall, temperature, and altitude, in combination with the corresponding tropical wet and dry seasons, play a part in the vines' growth cycle and dormancy. While the dry season mirrors the dormant period, pruning, defoliation, and the resumption of irrigation with a small dose of fertilizer will cause the vine to start growing. In the wet, humid tropics, vines can stay green and will seldom go dormant, growing continuously. Some vines, like 'Isabella', will simply "go native," and little is needed in addition to the normal wet, dry, hot, and cold periods that occur naturally around Hawai‘i for it to flower and fruit.



Grapevine terminology. Source: Anomyous (2002) University of Missouri.

Water stress during cooler months has also been used to induce dormancy. This is done by allowing weeds to grow around the vines, using up whatever soil water is available. This approach works best in dryer areas. After three weeks of stress, new vegetative growth and flowering follows after leaf removal, pruning, and irrigation.

In larger operations in India and Brazil, chemicals such as hydrogen cyanimide (Dormex) are used to stimulate uniform opening of buds. The use of this chemical in conjunction with the wet and dry seasonal changes facilitates two large harvests per year. Hand-pinching of new shoots and fruit growth on vines less than a year old should also be practiced.

Fertilizer

In Japan's southern grape-growing areas, up to 12 soil samples are taken per hectare. This can result in the usage of three or four different fertilizers, applied generally three times per year. In some cases no fertilizer and only heavy mulching is used, while in others, NPK of 10-8-8 or 12-12-16 is used on commercial production vines. In Chiba, Japan, 10-8-56 is used in September while 12-12-16 is used in summer. If the vines are weak, 20-4-8 is used.

In U.S. growing areas, annual tissue and soil analysis begins in the second year of production. This will determine the fertilization regime for the following year. Early grapes in Hawai‘i were mulched heavily, while current vines are given 6-6-6 or 8-8-8 supplemented with micronutrients if the analysis shows a need. This system is also used in some parts of Florida and Iowa.

Tools

A number of specialized tools are used in growing high-quality grapes in Japan. Notching sections of the vine to force growth is performed with a specialized shear that scores the bark just above the node, making it easier to bud. A small tool similar to a staple remover is used to thin clusters, leaving only a small group of grapes—about 25, depending on the variety—at the bottom of the bunch. This allows each grape to develop fully and helps to keep down diseases. A refractometer is used to measure the fruit's total soluble solids (TSS) content, which is approximately the sugar content. TSS is a better measure of ripeness than skin color.

Pests and Diseases

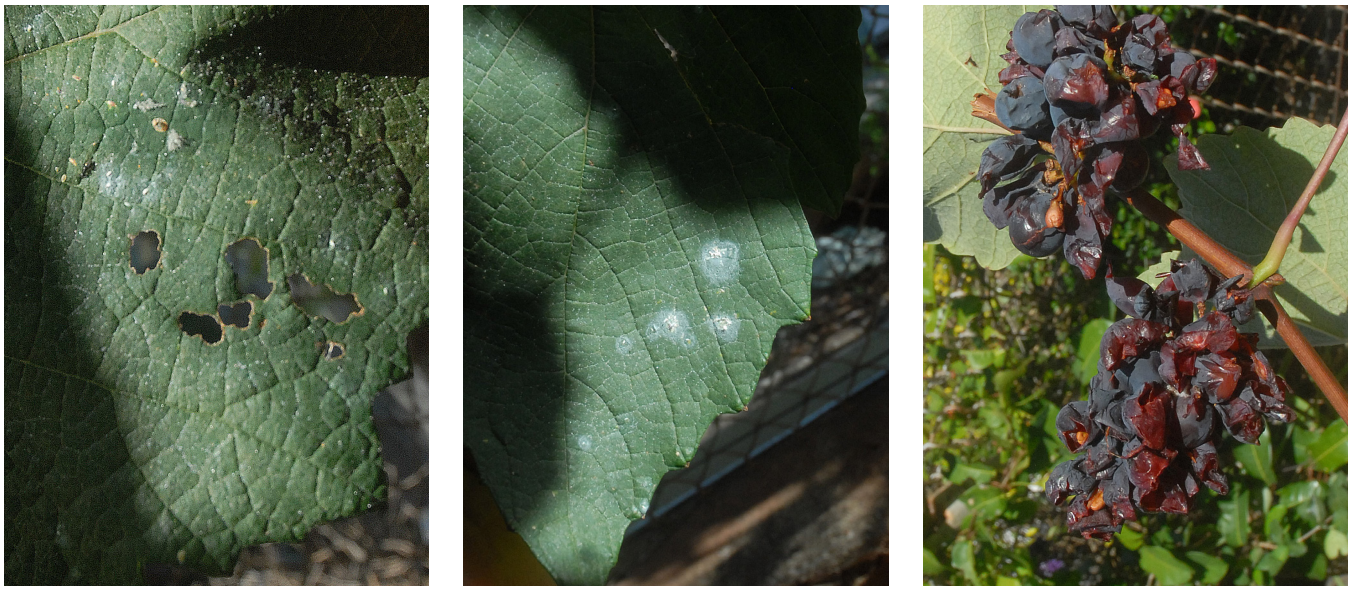
Knowing the diseases that affect grapes in the tropics is essential for high-quality fruit production. It's good to be aware of these diseases before planting. An area with more winds and low humidity will have fewer problems than areas with high humidity and little air flow through the vines.

- ***Powdery Mildew*** (*Erysiphe* spp. and *Sphaerotheca* spp.)
  A common disease found throughout the state, powdery mildew can be caused by different fungi. Control can be achieved with sulfur, neem oil, and other horticultural oils. Sulfur works best when applied before symptoms are obvious. These and other fungicides cannot be used if the grape leaves are to be used as food wrappings. Pruning to maintain an open canopy that allows good airflow helps to prevent powdery mildew.

- ***Downy Mildew*** (*Plasmopara viticola)*
  This fungus occurs during the vegetative growth cycle following extended periods of rain. Field sanitation can help prevent future outbreaks, as the spores survive on dead leaves. Insuring good drainage also helps as a preventative management strategy.

- ***Trunk Canker*** (*Botryoshaeria* spp.)
  This causes dieback of the trunk and vine arms owing to cankers in the woody tissue. Wounds from pruning provide the entry for pathogen. Good fertil-

Tools for bud stripping (left) and scoring (right).



Left to right: Insect damage to leaf, powdery mildew on leaf, and bird damage to fruit.

izer management and proper pruning and irrigation can enable the vines to outgrow the infection.

- ***Phylloxera***
  An aphid-like insect, *Daktulosphaira vitifoliae,* that feeds on the roots of grapevines causes this disease. Although other *Daktulosphaira* have been reported in Hawai‘i since the 1860’s, little is known about how this might affect today’s grape growing in Hawai‘i. The disease is usually controlled though the use of certified virus-free rootstocks, without *V. vinifera* parentage. Cultural practices that limit plant stresses are essential.

There are numerous other diseases, insects, mites, and nematodes that can affect grape vines. In all cases, good horticultural practices can prevent problems. The University of California at Davis has an aggressive integrated Pest Management (IPM) program for grapes. Details can be found at http://www.ipm.ucdavis.edu/PMG/selectnewpest.grapes.html

Some growers in Hawai‘i report treating half of the plants organically using sulfur dust and Bordeaux mixture to control mildew, and neem oil to control Chinese rose beetles. The other half of the plants were treated conventionally using Captan to control mildew and Sevin to control Chinese rose beetles. The vines treated with Captan and Sevin responded slightly better than those with the organic treatments, but the leaves were rendered inedible. Providing lighting to the plants during the growing season for a few hours after dusk each evening can also reduce damage by rose beetles.

Birds are a major problem for grapes in Hawai‘i. Using protective fruit-wrapping bags or newspaper can make the difference between having a crop and having nothing.

Harvesting and Yield

Some grape varieties can take up to six months to ripen, while others can ripen in two to three months. For varieties that flower and ripen fruit in less than three months, two to three crops are possible each year in the tropics. In Hawai‘i, some growers report three crops per year.

Fruit maturity at harvest is critical to marketing high-quality fruit. Harvesting too early can be a problem, as color is not necessarily a good indicator of ripeness. A refractometer is often used to measure soluble solids, and a range from 16% to 24% in ripe grapes is desirable, depending on the variety.

Every country, location, variety, and vineyard has different yields, and these yields can be expressed differently. In Europe, yield is given as volume of wine per hectare, with approximately 50 hectoliters (5,000 liters,

Paper coverings protect bunches from sunburn and birds.

1,300 gallons) per hectare being an average yield, while the rest of the world uses tons, averaging about 3 tons of fruit per acre. One ton/acre is equivalent to 2470 kg/ha and about 17.5 hl/ha or 17500 L/ha. An average industry figure is that it takes 1.25 kg (2.75 pounds) of grapes per bottle of wine and the average vine produces about 6.8 kg (15 pounds) of grapes, or 5 to 6 bottles.

Uses, Packaging, Pricing, and Marketing

Often grape growers are asked if they are producing wine or table grapes. For many chefs, it doesn't matter, as they are looking for different attributes than those that usually determine a grape's primary use. In Hawai‘i, locally grown grapes are highly sought after by chefs who use them in a variety of sauces and other culinary creations. The most common grapes in Hawai‘i, ‘Isabella', lend themselves to both cooking and eating out of hand.

An informal poll of Kona Kohala Chef Association members shows they expected to pay about $10.00 per pound wholesale in 2013. The desire for locally grown grapes is considerable, and those growers who undertake production as part of an overall diversified farm plan will find grapes a rewarding crop.

Table 2. Nutrient values for grapes, red or green (European type: ‘Thompson Seedless'), Nutritive Value per 100 g, ORAC Value 3,277 (Source: USDA National Nutrient data base)

Principle	Nutrient Value	Percentage of RDA
Energy	69 Kcal	3.5%
Carbohydrates	18 g	14%
Protein	0.72 g	1%
Total Fat	0.16 g	0.5%
Cholesterol	0 mg	0%
Dietary Fiber	0.9 g	2%
Folates	2 μg	0.5%
Niacin	0.188 mg	1%
Pantothenic acid	0.050 mg	1%
Pyridoxine	0.086 mg	7.5%
Riboflavin	0.070 mg	5%
Thiamin	0.069 mg	6%
Vitamin A	66 IU	3%
Vitamin C	10.8 mg	18%
Vitamin E	0.19 mg	1%
Vitamin K	14.6 μg	12%
Sodium	1 mg	0%
Potassium	191 mg	4%
Calcium	10 mg	1%
Copper	0.127 mg	14%
Iron	0.36 mg	4.5%
Magnesium	7 mg	2%
Manganese	0.071 mg	3%
Zinc	0.07 mg	0.5%
Carotene-α	1 μg	--
Carotene-ß	39 μg	--
Crypto-xanthin-ß	0 μg	--
Lutein-zeaxanthin	72 μg	--

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Web Resources

http://en.wikipedia.org/wiki/Grape

http://mrec.ifas.ufl.edu/grapes/history/. (University of Florida) Grape History

http://plants.usda.gov. Search under Vitis for species in the U.S.