


Grape Growing

By John Veremis

Plants have been the most important objects which people have borrowed from their neighbors in their business of advancing civilization. All the high civilizations have been built up upon cereal grasses, barley, wheat, rice, and maize. The introduction of the potato from the Andes to the Old World brought a series of major economic and social revolutions, and examples of the same kind are many.

But the case of grape-vine, *Vitis vinifera*, is a special and peculiar one. Its wine is not a necessity of any people's diet, yet it has colonized the greater part of those climatic zones which are congenial to it, and it has done so, very often to the detriment of the people's essential food supplies. There have been three principle forces for this, spleen, religion, and profit. First, the human condition being what it is, only a very small number of very primitive tribes have failed to develop some intoxicant to help man face the facts of life. Poppy juice, toxic fungi, the dried flowers of a coccus, the leaves of coco bush, but neither of them can compare in economic and social importance with alcohol. And the wine of the grape has long been the least concerning medium in which alcohol can be taken and the least liable to dangerous abuse.

Secondly, the strange power of intoxicants to release the human spirit from the control of mind led to their being regarded with superstitious awe. Their use became a religious rite and this was the case of wine, as of others. In the sixth century B.C., Orphism gave a new, long and civilized lease of power to the formerly savage and barbarous religion of Dionysus; the use of wine in the rites entered into the later religious of the Mediterranean peoples; and Christianity, by the encharistic use of wine, borrowed from elder cults, carried the religious significance of wine-drinking forward into the two Christian civilizations, the Greek and the Latin. The massive conservation of these two branches of Christianity accomplished what no other social force could have done--maintained the religious attribute of an intoxicant into a sophisticated technological epoch.

Thirdly, the cash yield per acre-man-hour of viticulture has nearly always been from three to ten times as great as that from any other kind of fanning or gardening. However, in fact, two forces working against the vine, one natural, the other social, have limited the spread of vineyards even further.

The origins of viticulture are so remote in time that nothing certain can be known concerning them. The genus *Vitis* is divided into two subgenera: the *Euvites*, including the greater number of species; and the *Muscodinioe*, with only three species. There are in all between forty and fifty species of true grape-vines, one native to Europe, twelve to Asia, and thirty-five to N. America. The genus *Vitis* has a much longer history than man. The earliest representative yet discovered is the fossil species *V. sezonnensis*, which flourished in the subtropical forests of what is now France during the Lower Eocene epoch. The grape-vine is one of the first plants to be domesticated by man. Where and when did man and vine come together in conditions favorable to the development of a partnership between them for the forwarding of civilization?

Wild grapes, hang down in clusters of great beauty, sweeter and juicier than most fruits. They are striking and tempting so that they would have received particular attention from food gatherers among communities fortunate enough to be living where vines could grow. If the gatherer of wild grapes found him/her self with more than his/her family could at once consume, he/she would put them into a vessel, and if the vessel happened to be of clay, so that the juice of any crushed fruit could accumulate, the grapes would begin to ferment, since yeasts are present in the bloom on the skins of all wild grapes. Sooner or later some thirsty member of a food-gathering community, not long after the first invention of pottery, would have taken a drink from a vessel which two or three days earlier contained grapes, but which now contained-wine. The behavior of the drinker depends on the amount of this discovered wine, as any wine-lover knows. There are a number of places in the world where this could have happened, and where it could have been followed by the cultivation of the vine, first by assisting it in its natural habitat, later by transplanting it. Most possibly regions south of the Black Sea, Anotolia, France, and Italy, in all of which countries V. vinifera silvestis was represented. The most advanced people anywhere near the habitat of the wild vines were those of Tigris-Euphrates valleys, since they were the first to create an urban civilization. Viticulture was almost certainly established in Tigris-Euphrates soils before 4000 B.C. and perhaps much before. The vine was, and is native to Transcancosia. This region was inhabitated between 6000 and 4000 B.C. by people in a late Paleolithic or early Neolithic stage of culture, who later must have come under the influence of cultural energy radiating from the south, and who had probably long collected wild grapes and made wine form this wild harvest. The source of life for the Mesopotamian people was the flood-water of the Tigris and Euphrates Rivers. The source of these rivers must have been of interest to them, and all the land to the north and west through which the rivers flowed from a time before the city-building phase of Mesopotamians must have been used to trading abroad, timber, and other primary materials being scarce of wanting in their country. and copper had to come from beyond their frontiers. Some of these materials were most nearly available in the hill country to the north and east.

The earliest reference to vineyard in literature is in the earliest work of literature, the Epic of Gilgamesh written about the time of Haminurabi, that is the eighteenth century B.C., but refers to a much earlier epoch. By 3000 B.C. at the latest and probably much earlier, viticulture having come down from ancient Armenia, had reached an advanced stage of sophistication in the states of Mesopotamia, in all the lands of Syria and Phoenicia, and in the Egyptian Delta; that its extreme southern point in prehistoric times was Meroe, and that its very great antiquity even by the year 3000 B.C. is vouched for by the

diversification of the species *Vitis vinifera*, for such diversification is a work of much time.

Vines closely related to those which had given rise to the cultivated varieties of the East grew in the woods of Greece, but the people were never to be called upon to go through the long, slow process of taming these wild plants.

By the time of Homer, wine was not only the ordinary drink of the Greeks, but was clearly regarded as one of the country's natural products. Although we believe that the poet was working-up traditional history into a poem centuries after the events described occurred it is certain that wine had long been "natural" in Greece and was as necessary to the Homeric Greeks as bread and meat. More to the point, not only do young maidens drink wine, but children seem to have been brought up on it, at least if they were intended to be heroes; for the infant Achilles was given wine with his meals, as is still given to modem Greek children.

The Minoan civilization, with its center in Crete and its colonies in the Aegean Islands, in southwest Asia Minor and in Argos, apparently had its down in the third millennium B.C. The colonies do not belong to the earliest epoch, and Early Mycenoeon is dated from 1800 B.C. The Early Mycenoeouns could have had wine from Crete and could probably also have cultivated their own vineyards. The Cretes were among the very ancient people of the vine, and they could have had it from either of both of two sources: Egypt and Phoenicia that had for close relations. The historic Greeks, or some of them known, indeed that wine and art of cultivating wine came to them from Crete. Another equally probable route of vine and wine into Greece may be the people of Asia Minor that introduced it into Thrace and so into Greece as an ancient myths embodied. What came into Greece from Asia from any route was the power to release, or rather to unlease, in ourselves the carefully suppressed creature of immediate apprehensions capable of enjoying experiences and having knowledge which man, as man and not either beast or god, has been obliged to suppress in himself. It is amusing to find, in innumerable classicists, a certain head-shaking over the conduct of the Olympia gods in general. Greeks recognized in even the creature with the mind of man and the free instincts of the beast, which man can himself be at the cost of sacrificing social order and therefore civilization. The Man-Plant- God, the True Vine, Dionysus is a dual creature: capable of attacking the very seat of reason and humiliating when as he releases them from their self-control, yet that he does only to chastise.

By tracing the diffusion of vine-planting and wine making that is, by trying to follow the rise and growth of the new Apollo-Dionysus cult through Greece, it would seem that from Thrace these arts spread throughout Greece. A study of the names of the principal objects involved, and of world wine itself, reveals an immediately Semitic source of Hellenic viticulture. The Greek word oivos Latin vinum, Italian vino, French vin, English wine, etc. is the same as the Hebrew word yain and the Arabic word wain. The words correspond to a Semitic origin in some part of Asia Minor. The true home of the vine south of the Caspian Sea, close to the cradle of the Semitic race. But there is a theory that some sort of very primitive viticulture was practiced, or at least that wine was made from wild grapes, by the ancient people who spoke the proto-language called Indo-European, which as far as I know is hypothetical.

Whatever can be gathered from fragments of textbooks tends, however, to confirm the men of letters and their mythical sources; if myth and poetry point to Thrace as the first wine country of Greece, so does the imphenus antignity of the Mararean wine which Ulysses used to make Polyphemus blind-drunk. Other parts least-civilized of the Hellenic states, Macedonia, Epirus, Carinth and Arcodia were well known for their wines. However the farming situation in Greek viticulture with the majority of small freeholds farmed their own land they could not produce in quantity. By the Roman times Greece had become to the whole Mediterranean world what France is to us, the land of wine. Greek wine was however, an article of luxury, for it was relatively scarce as mentioned already. The Mycenaeans Greek "Sea People" as called, conquered the Mediterranean Sea with their arms and arts. It is now held that viticulture, including at least some cultivators of the vine, was introduced by the Greek colonies who created Magna Graecia. in Sicily between the ninth and seventh centuries B.C. The Romans, a people to whom wine was unknown in their primitive phase by the first century B.C., wine had become the daily drink of all Italians. It is very probable that the first cultivated grape-vines to be established in France also were planted by the Phacaea colonies from Greece who founded Marseilles. The natives of what is now Provence-Ligurians, Iberian, Celts began by buying wine from the Massiliotes, but as usual this wine was only for the aristocracy; their poor drank a kind of beer. For these transport the wine on the navigable rivers by boats and through the level plain on wagons, and receive for it an incredible price; for in exchange for ajar of wine they get a slave! If we examine the viticulture in the East (Harold N. Moldenke, "Plants of the Bible" p. 239-244), the common grape-vine, Vitis vinifera is mentioned throughout the Bible, from the days of Nean 2347 B.C. to those of Jesus. Prophets, patriarchs, psalmists, and apostles all spoke of it, often employing it in a symbolic sense Jesus compared himself to that "true vine" of which his disciples were the branches. JOHN 15: 1 - 6. "I am the true vine, and my Father is the husbandman." It is a singular circumstance in the history of viticulture that the vine was to meet with and be checked by its sternest enemy in the lands of its most ancient prosperity. So well established in our minds is the notion of the antipathy between Islam and wine that we now never associate Anotolia, Syria and Palastine, for example, with vineyards and vintages; whereas as we have seen, until the eighth century almost every country of the eventual Dar- al-Islam was vine country. The Jency of Egypt had been drinking wine for at least four thousand years before Mahowet saw fit to declare war to Dionysus. They were obliged to see their ancient vineyards destroyed by the same barbarians as burnt the library of Alexandria. By the Middle Ages they were having resource to bootlegging. There were two islands which, being Christian were still Ginophil, and were conveniently close as source of wine: Cyprus and Crete. Cyprian wine was regarded as unquestionably the best in the world. For some reason however, the Egyptian bootleg Genoese canoes would not run it from Cyprus but from Crete. Nevertheless, it remains true that Mohomet did triumph over Dionysus: the very heartlands of the god were robbed of their wine-bearing vines and his most ancient worshipers have long ceased to be people of the vine. In the seventeenth century, when France emerged as the leader of European culture, French viticulture began to be something more than a mere branch of agriculture in that country, and by the nineteenth, had become what Greek and Italian viticulture had formerly been.

V. vinifera was brought by the Spaniards in Mexico and areas now occupied by California and Arizona. The mission vines that were introduced flourished and some grew to a huge size. English settlers brought the Old World grape with them and made plantings along the Atlantic seaboard. In spite of repeated attempts, these vineyards were a failure because of the presence of insect phylloxera, and

fungus diseases, such as black rot, tarny mildew, and powdery mildew, as well as the low winter temperatures and the hot humid summers of the eastern states. Out of what happened in America came the greatest disaster ever suffered by the viticulture of the Old World; and by way of compensation, the solution to the problem created by the disaster. By 1860 California had become, in two centuries, one of the worlds greatest vine and wine lands. And much of this triumph was owed to Louis Vignes and Agoston Haraszehy, than whom very few men have served Dionysus better.

If we examine the viticulture in the East (Harold N. Moldenke, "Plants of the Bible" p. 239-244), the common grape-vine, *Vitis vinifera* is mentioned throughout the Bible, from the days of Nean 2347 B.C. to those of Jesus. Prophets, patriarchs, psalmists, and apostles all spoke of it, often employing it in a symbolic sense Jesus compared himself to that "true vine" of which his disciples were the branches. JOHN 15: 1 - 6. "I am the true vine, and my Father is the husbandman." It is a singular circumstance in the history of viticulture that the vine was to meet with and be checked by its sternest enemy in the lands of its most ancient prosperity. So well established in our minds is the notion of the antipathy between Islam and wine that we now never associate Anotolia, Syria and Palastine, for example, with vineyards and vintages; whereas as we have seen, until the eighth century almost every country of the eventual Dar- al-Islam was vine country. The Jency of Egypt had been drinking wine for at least four thousand years before Mahowet saw fit to declare war to Dionysus. They were obliged to see their ancient vineyards destroyed by the same barbarians as burnt the library of Alexandria. By the Middle Ages they were having resource to bootlegging. There were two islands which, being Christian were still Ginophil, and were conveniently close as source of wine: Cyprus and Crete. Cyprian wine was regarded as unquestionably the best in the world. For some reason however, the Egyptian bootleg Genoese canoes would not run it from Cyprus but from Crete. Nevertheless, it remains true that Mohomet did triumph over Dionysus: the very heartlands of the god were robbed of their wine-bearing vines and his most ancient worshipers have long ceased to be people of the vine.

The grape is the most widely planted fruit crop in the world, covering an area of approximately 10 million hectares. It grows from temperate to tropical regions, but most vineyards are planted in areas with temperate climates. The most concentrated cultures are in Europe. In 1983, the United States ranked seventh in grape acreage worldwide. Grapes we also grown widely in countries of the Southern Hemisphere. the grape is a crop plant of many uses. Its fruit is fermented to wines and brandy. It is also eaten fresh and, through the use of cold storage and production in the Southern Hemisphere, is available throughout the year. The fruit is also dried into raisins. Nonfermented juice, frozen juice concentrate, and preserves are common uses for the fruit in North America and other markets. In 1982, the commodity value of grapes for fresh and processed uses in the United States was $1.34 billion, second only to potatoes among all fruits and vegetables.

The grapevine consists of basic portions; the roots which are normal underground, and the trunk, arms, and shoot which are usually aboveground. The shoots consist mainly of stems, leaves, and flowers or fruit. The vine consists of cells and the product of cells, and is an interlaced collection of living and nonliving cells. The flower and fruit comprise the reproductive parts of the vine. An inflorescence (flower cluster) is initiated during late spring and summer preceding the year in which flowering and fruiting occur. The cluster occurs opposite a foliage leaf in the same position as a tendril. The flowers

usually bloom about 6-10 weeks after the beginning of shoot growth, depending on climatic conditions. Flowers are born in clusters, and there may be several hundred flowers per cluster. Most *vinifera* varieties have perfect or hermaphroditic flowers that have both a functional pistil and stamens. During bloom, pollen grains fall upon the stigma where, under favorable conditions, they germinate. Antithesis occurs mainly between 6 and 9 a.m. with a rising air temperature. Fertilization occurs 2 or 3 days after pollination. The ovary then develops into the grape berry. There are various types of branch shapes such as cylindrical, conical, pyramidal, globular, or round branches. The berry consists of skin, pulp, and seeds.

Like most other plants, the grapevine has a fairly predictable cycle of growth. Dormant period begins in autumn in temperate regions when the vine sheds its leaves. Dormancy can be divided into periods of quiscence under exogenous control in which buds fail to grow because of unfavorable external conditions and rest under endogenous control, in which internal forces prevent growth despite favorable environmental conditions. In the spring, when the mean daily temperature reaches about 50 degrees F (10 degrees C) the buds begin to swell and the green shoots emerge from them. This is commonly known as bud break. Blooming usually occurs around 8 weeks after bud break and rapid shoot growth in length usually begins to slow down. The process of flower initiation for the following years crop begins before bloom and the development continues until about harvest time. Several days after the bloom period, pistols and impotent berries--often 50 to 60 percent or more--shatter from the cluster. The amount of set varies form season to season. The set are the berries that do not fall and this is referred to as the fruit-set stage. When the increase in such variables as volume, fresh weight, dry weight, and diameter of the fruit is plotted as a function of time after antithesis, seeded grapes are characterized by a double-sigmoid curve.. The green stage of berry growth lasts from the setting of the berries up to veraison, the time the berries begin to color and soften and the ripening stage begins. As ripening progress, the color becomes more intense, the amount of sugar increases, and acidity decreases, finally the grapes dry and raisin, and in many varieties unpicked grapes remain on the vine until they are removed by pruning.

Vines grown from seeds usually differ markedly from each other and from parent vines. Seeds are not used to propagation because the seedlings are usually of lesser quality than the parent vine in regard to vigor, productivity, quality of fruit, and wine produced form the fruit. However, seeds are valuable in breeding work and development of new varieties. In the past 200 years man has attempted to produce new grapes that better suit his needs. About 25 million acres (10,121,000 hectares) of grapes are grown worldwide. There are around 8,000 varieties of grapes in the world that have been named and described. Grapes are divided into five main classes, depending on their purpose: table, wine, raisin, juice, and canning.

Wild and cultivated grapevines belong to the family Vitaceae which includes living and two fossil genera and more than a thousand species. Grapevines are perennials grown from rooted hardwood of softwood cuttings or from grafts of the scion cultivar on a rootstock. In propagation by cuttings, a portion of the cane is cut from the parent plant, and this plant part is then placed under favorable environmental conditions and included to form roots and shoots, which results in the production of a new plant that is usually identical to the parent plant. There are several methods to field budding, or

graft fruiting varieties onto rootstocks, and the type used usually depends on the size of the stock. Humans planted *V. vinefera* as a crop as far back as 5000 B.C. In the Near East and southern Europe, superior types were selected form wild vines and gradually domesticated. Most cultivars used in present-day viticulture were selected and named before any historical ampelographic documentation. Problems developed in grape production in European vineyards after the introduction of grape diseases and pests from the New World between 1850 and 1878 especially the infestation of phylloxera, in 1863. These diseases and pests were unknown in the old vineyards that had been planted before 1850. By 1878, only 20% of vines in Germany gave a satisfactory yield, 40% gave a very low yield, and 46% gave no yield at all. Poor performance led to early clonal selection, which predated the development of the modem disciplines of plant genetics, plant pathology, and viticulture, and the wide use of phylloxera resistant rootstocks. Clonal selection, during the late 19th century was chiefly either negative or positive mass selection until 1876, when individual mother vine selection was introduced in the Palatinate in Germany with the cultivar Sylvanes. In the original mass selection schemes, negative variants in the vineyard population were excluded from vegetative propagation and only vines with above-average performance were propagated. After the individual mother vine selection scheme was introduced, only one vine with top performance was selected for propagation. With this individual mother vine selection system for reconstructing vineyards, average must yields in the German wine industry have increased from 3,000 to 10,400 L/ha in the past 100 years without altering wine quality. The individual mother vine selection scheme in Germany is a complex set of observations and replicated yield and quality test requiring 20 years to complete. During the tests, 30 characteristics are measured and used for selection. The tests measure stress resistance, as well as, quality factors in vines, and wine. Tests are optimized to select stable performance, clones with small annual variation in yield. also every effort was made to pick clones free of dangerous viruses. The California selection scheme is made in a fashion similar to the German system, and indexing for serious virus disease problems is conducted before materials are registered with the Foundation Plant Materials Service in Davis. In either scheme the measurement of true somatic mutation effects will be possibly only when virus disease infections are completely eliminated.

Vine hazards include viral, fungal, and bacterial diseases, insects, noxious weeds, birds, rodents, and deer, and Frost Disease in general are endemic (native, prevalent, and well-established). Disease development depends on weather, if favorable to disease, epidemics may occur with losses ranging from 20% to 80%, for example prolonged periods of wet weather favor *Botrytis* Gunch rot, downy mildew, and other fruit and leaf spot diseases. *Phemopsis* cane and leaf spot can cause devastating epidemics in protracted periods of wet, cool weather. *Anchranose* or bird's-eye rot is a disease of European origin. Before the introduction of powdery mildew and downy mildew *Antracnose* was the most damaging grape disease in Europe. *Antracnose* is a disease of rainy, humid regions, where some grape cultivars are practically impossible to grow because of the disease. Other disease caused by fungi in fruit and foliage are Rotbrenner, Bitter white ripe, and macrophona Rot Diseases caused by bacteria and bacterialike organisms are crown gall, bacterial blight, Pierce's Disease, and grapevines yellows diseases. Diseases caused by viruses are Fanleaf Degeneration, Leaf roll, Peach Rosette mosaic virus decline and stem pitting. Nematode parasites in vine are particularly insidious because symptoms of their attack are obscure, generally comprising, unthrifty, weakened vines. Spider and grape mites are common pests of grapevines. Leafhoppers and treehoppers are especially important insects to consider because injuries

they cause by feeding and oviposition on vines are often confused with symptoms produced by diseases. The grape phyfloxera is an insect of worldwide distribution. Its only known host is grapes. The life cycle of phylloxera. is complex; some individuals feed on roots and others feed on foliage.

The effect of diseases on grape production are found throughout the records of viticulture. Diseases affect production, harvesting, processing, marketing, and the consumer. They lower quality, reduce yield, and increase the cost of production. Catastrophic diseases alter crop patterns, and may have long-term effects on local and export markets. The historic event, in 1885, P.M.A. Millardet first used fungicide: copper sulfate, lime, and water (Bordeaux mixture) to control downy mildew near Bordeaux, France. Although grape pathogens are dynamic and their explosive powers are awesome, through research and development they have been brought under control. Humankind still after 7000 years of viticulture and war with biotic and abiotic enemies, worship Dionysus, the Greek God of grapes.

REFERENCES

ANWAR, S.A. and VAN GUNDY, S.D. Influence of four nematodes on root and shoot growth parameters in grape. Journal of Nematology. Vol. 21. Pages 276-283. April 89.

HYAMS, Edward. Dionysus. Macmillan Company, 1965.

HIMELRICK, David G. Training and pruning French-American hybrids. American Fruit Grower. Vol. 109. Pages 17-18. October 89.

LANE, R.P. and BATES, R.P. Golden Isles' muscadine grape for wine. HortScience. Vol. 22. Pages 165-166. February 87.

PEARSAN, Roger C. Compendium of Grape Diseases. APS Press, 1988. PETRUCCI, Vincent. Seedless grapes the way to go. American Fruit Grower. Vol. 110. Page 22+. January 90.

WEAVER, Robert J. Grape Growing. John Wiley and Sons, 1976.

WEST, D.W. and TAYLOR, J.A. Response of six grape cultivars to the combined effects of high salinity and rootzone waterlogging. Journal of the American Society for Horticultural Science. Vol. 109. Pages 844-85 1. November 84.

EBL HOME PAGE
