Grape Growing (Viticulture)

Grape Vines

- The grape is the fruit of a vine, a member of the ***Ampelidaceae*** family.
- Winemakers are concerned only with the *Vitis* genus of that family, which is divided into a number of species.
- ***Vitis vinifera***, is our major concern, for more than 99 per cent of all wines are made with this species.
- ***Vitis labrusca*** are grown for wine in Canada and Eastern United States. ***Vitis riparia, Vitis berlandieri*** and ***Vitis rupestris*** often provide the rootstock on which *Vitis vinifera* scions are grafted.
- Nearly all commercial grape varieties are **hermaphrodite** (contain both male and female organs) within the same flower.
- **Anthers, pollen, stigmas, transfer of genetic material, fertilization**.
- The expressed characteristics that interest a winemaker are aspects such as **yields, hardiness, disease-resistance, fruit character and levels of tannin, acidity and sugars** within the grape.
- The grape variety accounts for a large part of the style and quality of many wines, which is why it is common (and becoming more so) for wines to be labeled by variety.

Hybrids

- A scientist or nursery is capable of effecting **artificial evolution** by 'marrying' two separate species, in order to gain the benefits of both.
- One might combine the low vigour and phylloxera tolerance of *V.riparia* with the deep roots and phylloxera resistance of *V.rupestris*. The resulting hybrid might then be fertilized with another hybrid that has tolerance of alkaline soils from a phylloxera resistant *V.berlandieri* parent.

Crossings

- Crossings occur when **reproduction takes place the normal way**, when parents are **different varieties** of the **same species**.

Clones

- Growing a plant from a **cutting** requires the **genetic instructions to be copied** every time a new cell is created.
- **Occasionally mutations occur**. The slightly different mutations during the cloning process are said to be **different clones of the same variety**. Within a variety, some **clones may show outstanding traits**, such as a **particular flavour, high yields or disease resistance.**

Grafting (and Phylloxera)

- **Destruction of European vineyards** by the **phylloxera louse** (**Dactylasphaera *vitifoliae,* a small [1 mm long] yellow root-feeding aphid***).* First noted in **France in 1863**, peaked in **1889** with 2.5 million ha/ 6.2 million acres of vines destroyed).
- The **wounds that the louse makes** while feeding on the vine roots allow **bacteria and fungi** to enter, leading to **decay, rot, and disease** and the **eventual death** of the *vinifera* vines.
- **American vines form protective layers** beneath the feeding wounds, thus preventing further damage.
- **European varieties could be resistant to phylloxera** if they were **grafted on to American rootstock**, and at the same time **maintain their European flavour** profile.
- **Grafting**; the **connection of two pieces of living plant tissue so that they unite and grow as one** plant.

Climate Classification

- Climate can be understood as to what weather can be expected in a typical year.
- The most important aspects of climate for the vine are temperature and rainfall.
- Climate can also depend on many factors, including latitude, altitude, topography and proximity to bodies of water.

Maritime Climate: Warm summers, mild winters.

Mediterranean Climate: Maritime climate where most of the rainfall occurs in winter.

Continental Climate: Hot summers, cold winters.

Weather

- Some regions have very stable climates, with little variance from one year to the next. Generally, the cooler the climate the greater the variation and the greater difference from vintage to vintage.

Degree Days

The growing **degree day or heat unit theory** assumes that plants growth commences at a particular base temperature. It has been determined for grapes, that the **growth begins at the mean temperate of 10 degree C**. The accumulation of growing degree days throughout the growing season above the 10 degree C. base temperature permits the **assessment of grape growing potential** in a region.

Class	Degree Day	Ranking
1	1390 and above	most suitable
2	1165 to 1389	good suitability
3	945 to 1164	fair suitability
4	less than 945	questionable suitability

The use of grape degree day concept provides information as to **the varieties of grapes** that can be grown and the quality of the wine. **Vineyards in class 4 on average will experience a shorter growing seasons and the wines tend to be acidic**.

Grapes grown in class 1 will have the longest growing season. Wines produced in these regions will have a higher alcohol content and will be somewhat sweeter and mellower than wines produced from less suitable areas. The **grapes in class 2 and 3 will have higher acid concentration than if they had been grown in class one region. In many cases the grapes grown in class 2 have higher intensity of aromas.**

The **degree day concept is not without drawbacks** because there **is no accounting for a lessening in plants response at temperatures more than 27C**. Also there is **no accounting for differences between maximum and minimum temperature for of each day**.

Soil and Wine Quality

- Old World opinion often places a greater emphasis on the notion of **terroir** and soil type.
- France's Appellation Contrôlée system is largely based on the concept of terroir.
- The most suitable types of soil for vine growing are well-drained, with a steady, but only moderate supply of water to the vines.
- Surface soil colour also impacts vine growth and grape ripening.
- The amount of stones within a soil can lead to greater levels of drainage. Surface stones and rocks can diminish rates of evaporation of the soil.

Soil Types

Alluvial: Sediment, fine grained, typically fertile. Mix of silt and sand. Located on flood plains, river beds, deltas and estuaries

- Marlborough, NZ
- Sauvignon Blanc

Chalk: Soft crumbly, highly porous (good drainage), pure white, easily penetrated by vine roots.

- Champagne, France
- Jerez, Spain
- Green grapes – white soil for white wines.

Clay: Sediment, small particles, water retaining.

- Pomerol, France

Granite: Coarse-grained, crystalline rock, made from quartz and other minerals.

- Baden, Germany
- Beaujolais, France

Gravel: unconsolidated rock, pebbles. Good drainage.

- Chateauneuf-du-Pape, France
- Gimblett Gravels, NZ
- Merlot, Syrah, Grenache.

Limestone: Mineral calcite, grey colour (can be red-brown depending on mineral content)

- Mediterranean. Coonawarra, Australia.
- Cabernet Sauvignon, Shiraz/Syrah.

Loam: Mixture of clay, silt and sand. High capacity to store water and nutrients. Ideal for plant growth, but not good for viticulture when rainfall is high.

Loess: Light coloured, fine grained, accumulation of silt and clay that have been deposited by wind.

- Germany and Austria
- Riesling, Grüner Veltliner

Marl: Crumbly combination of limestone and clay.

- Meursault, Jura and Tavel, France. Rheinhessen, Germany

Sand: Sediment or soil with relatively large particles. Poor ability to store water and nutrients.

- Colares, Portugal. Baja, Mexico

Sandstone: Sedimentary rock composed of sand grade particles of quartz. Varies in fertility and drainage.

Slate/Schiste: Coarse crystalline metamorphic rocks that can be split into layers.

- Duoro, Portugal. Alsace, France. Mosel-Saar-Ruwer, Germany.

Tuffeau: Calcareous soil, but with much better drainage than most limestone soils.

- Loire Valley, France
- Cabernet Franc

Volcanic: Rocks that are the product of volcanic eruptions, variable in composition.

- Pfalz, Germany. Sicily, Italy.

Establishing a Vineyard

- Planting occurs for two reasons; to plant a new vineyard or replace an existing one.
- Vines can live to be a century old or more, but as they age, production diminishes. While the quality can increase with old vines, there needs to be a balance between quality and profitability.
- The more dense the planting the greater the stress placed on the individual vines and ideally, the better the fruit.

Pruning

- Depending on the type of vine training, pruning is based on either cane or spur pruning.
- **Winter pruning** is performed to select the buds that will form shoots for the production of fruit for the coming harvest and to prepare the vine for fruiting of future harvests.
- **Summer pruning** may me done to restrict vegetation and concentrate the vigour of the vine into the production of fruit; control leaf canopy so that the grape bunches get the desired amount of sun or shade they require; to allow aeration to minimize the risk of fungal disease.

Training

- **Bush training** or **goblet** is used in warmer regions (Rhône Valley, Rioja, Australia). The vines are free standing and normally 4 to 5 spurs are left around the trunk of the vine. This is not a good system where humidity is high and there might be rot, or where mechanization is desired.
- The **replacement cane system** is where canes are trained along lateral wires with new producing canes being used every year.
- The **cordon spur system** is where the trunk is trained horizontally, with a number of spurs left along its length.
- The **parral** or **pergola** is when vines are trained high on pergolas, with bunches of grapes generally head height, for cover in hot climates.

Harvesting

- By hand is the traditional method and allows a much more rigorous selection of the grapes.
- Machine or mechanical harvesting is much faster, but with out the individual bunch selection.

Yield Management

- Excessive yields may result is grapes failing to ripen properly as the sugars produced in the leaves are shared between too many grapes.
- Large crops, heavy rainfall or excessive irrigation can lead to grapes that lack flavour and character.
- Factors that determine yields:
    - Number of vines per hectare, determined at planting.
    - Number of buds to the vine, determined at pruning.
    - Number of shoots, dependent on bud-burst, soil and climatic conditions.

    - Number of clusters to the shoot. This is the fruitfulness, determined the previous spring when the bud was formed.
    - Number of berries to the cluster, determined by the flowering. This is dependent on the weather at the time of flowering (millerandage).
    - Weight of the berries. Dependent on grape variety, the number of berries, the amount of rain or irrigation. The amount of nutrients available to the vine.
    - Green harvesting.

Biodynamics

- Biodynamics is a wholistic farming approach developed Austrian scientist-philosopher Rudolf Steiner.
- Encompasses many of the principles of organic farming, such as the elimination of all chemicals, Biodynamics goes further, requiring close attention to the varied forces of nature influencing the vine. It also emphasizes a closed, self-sustaining ecosystem.
- Biodynamic certification is achieved through the Demeter Association, an independent third-party certifier for traditional Biodynamic farming practices. The certification is extremely difficult to achieve, must be renewed every year and is the ultimate guarantee of purity in agricultural products.

The Demeter Association requires vineyards to meet a strict set of guidelines. They include:

- No use of artificial fertilizers, pesticides or herbicides.
- The promotion of crop fertility through compost, manures, green manuring and crop rotations, along with regular application of Biodynamic compost preparations and field sprays.
- Pest control through soil management; Biodynamic sprays and teas; crop rotations and diversification; and promotion of diverse animal, bird and insect populations that lead to self-regulating predator and prey relationships.
- Weed control by cultivation and other mechanical methods.
- The majority of composting materials must be self-generated by the farm.
- The farm must be free of prohibited inputs for 36 months and under Biodynamic management for 24 months prior to certification.

Vineyard Calendar

- Based on average year in Northern Hemisphere.