Viticulture - Characteristics of the vine - Growth Cycle of the Vine

DEFINITIONS

- Process that takes place in the vineyard each year, beginning with bud break in the spring and culminating in leaf fall in autumn followed by winter dormancy.
- From a winemaking perspective, each step in the process plays a vital role in the development of grapes with ideal characteristics for making wine.
- Viticulturalists monitor the effect of climate, vine disease, and pests in facilitating or impeding the vines progression from bud break, flowering, fruit set, veraison, harvesting, leaf fall and dormancy-reacting if need be with the use of viticultural practices like canopy management, irrigation, vine training, and the use of agrochemicals.
- The stages of the annual growth cycle usually become observable within the first year of a vine's life.
- The amount of time spent at each stage of the growth cycle depends on a number of factors - climate and grape variety.

STAGES

- Bud Break
- Flowering
- Fruit Set
- Veraison
- Harvesting
- Leaf Fall
- Dormancy

BUD BREAK

- April/May in the northern hemisphere, September/October in the souther hemisphere.
- Begins with daily temperatures being to surpass 10C (50F).
- If the vine had been pruned during the winter, the start of this cycle is signaled by a "bleeding" of the vine.
- This bleeding occurs when the soil begins to warm and osmotic forces pushes water, containing a low concentration of organic acids, hormones, minerals and sugars, up from the root system of the vine and it is expelled from the cuts (or wounds) left over from pruning the vine.
- During this period a single vine can "bleed" up to 5 liters (1.3 US gal) of water.
- Tiny buds on the vine start to swell and eventually shoots begin to grown from the buds.
- Buds are the small part of the vine that rest between the vine's steam and the petiole (leaf stem).
- Inside the buds contain usually three primordial shoots.
- These buds appear in the summer of previous growth cycle green and covered in scales.
- During winter dormancy they turn brown until the spring when the vine begins the process of bud break and the first sign of green in the vineyard emerges in the form of tiny shoots.
- The energy of facilitate this growth comes from the reserves of carbohydrate stored in roots and wood of the vine from the last growth cycle.
- Carbohydrates stored over winter in the roots return to the trunk and canes as sap to provide nutrients for budburst.
- Eventually the shoots sprout tiny leaves that can begin the process of photosynthesis, producing the energy to accelerate growth.
- In warm climates, after about 4 weeks the growth of the shoots starts to rapidly accelerate with the shoots growing in length an average of 3cm (1in) in a day.
- In temperate climates, where temperatures can reach above 10C (50F) in mid-winter, some early budding varieties (such as Chardonnay) can be at risk of premature bud break.
    - This is a potential viticultural hazard in places like Margaret River region of Western Australia where warm currents from the Indian Ocean can coax Chardonnay vines to prematurely bud in the mid-winter month of July.
    - After bud break, the young shoots are very vulnerable to frost damage with vineyard managers going to great lengths to protect the fragile shoots should temperatures dramatically drop below freezing. This can include setting up heaters or wine circulators in the vineyard to keep cold air from settling.
- Rapid shoot growth occurs from May to August (northern) and October to January (southern).

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FLOWERING

- April/May in the northern hemisphere, September/October in the souther hemisphere.
- Depending on temperatures, 40-80 days after bud break the process of flowering begins with small flower clusters appearing on the tips of the young shoots looking like buttons.
- Flowering occurs when average daily temperatures stay between 15-20C (59-68F).
- A few weeks after the the initial clusters appear, the flowers start to grow in size with individual flowers becoming observable.
- It is during this stage of flowering that the pollination and fertilization of the grapevine takes place with the resulting product being a grape berry, containing 1-4 seeds.
- Most V. vinifera grape vines are hermaphroditic, with both male stamens and female ovaries, being able to self-pollinate.
- At the beginning of the flowering process the only part this is visible is the fused cap of petals known as the calyptra.
- Shortly after the calyptra is shed, liberating the pollen from the anthers of the stamen.
- Wind and insects play only a small role in aiding pollination, with the process being mostly self-contained within the vine.
- Cross-pollination between vine species is possible.
- During the process of fertilization, the pollen fertilizes the ovary which produces seeds as the flower begins the transformation into a grape berry, encapsulating the seed.
- Detrimental weather can severely affect the flowering process, causing many flowers not to be fertilized and produce a group.
- It is during this time when the buds that will become next years crops begin to form.

FRUIT SET

- May in the northern hemisphere, November in the southern hemisphere.
- The stage of fruit set follows flowering almost immediately, when the fertilized flower begins to develop a seed and grape berry to protect the seed.
- This stage is very critical for wine production since it determines the potential crop yield.
- Not every flower on the vine gets fertilized, with the unfertilized flowers eventually falling off the vine.
- The percentage of fertilized flowers averages around 30 but can get as high as 60 or be much lower.
- Climate and the health of the vine play an important role with low humidity, high temperatures and water stress having the potential of severely reducing the amount of flowers that get fertilized.
- Coulure occurs when there is an imbalance of carbohydrate levels in the vine tissues and some berries fail to set or simply fall off the bunch.
- Varieties like Grenache and Malbec are prone to this abnormal fruit set.
- Millerandage occurs when some fertilized flowers do not form seeds but only small berry clusters.
- Grape berry size depends on the number of seeds so berries with no seeds will be significantly smaller than berries containing seeds.
- On one cluster there may be berries of various sizes which can create problems during winemaking due to the varying “skin to pulp” ration among the grapes.
- This can be caused by vine disease such as fan leaf, or by a boron deficiency in the vine.
- Gewuztraminer and the Chardonnay clones 1A and Mendoza are both prone.

VERAISON

- End of July into August in the northern hemisphere, and end of January into February in the southern hemisphere.
- Following fruit set, the grape berries are green and hard to the touch.
- They have very little sugar and are high in organic acids.
- They begin to grown to about half their final size when they enter the stage of veraison.
- This stage signals the beginning of the ripening process and normally takes place around 40-50 days after fruit set.
- During this stage the colors of the grape take form-red/black or yellow/green.
- This color changing is due to the chlorophyll in the berry skin being replaced by anthocyanin (red grapes) and carotenoids (white grapes).
- In a process known as engustment, the berries start to soften as they build by sugars.

- Within six days of the start of veraison, the berries begin to grow dramatically as they accumulate glucose and fructose and acids begin to fall.
- The onset of veraison does not occur uniformly among all berries.
- Typically the berries and clusters that are most exposed to warmth, on the outer extents of the canopy, undergo veraison first with the berries and clusters closer to the truck and under the canopy shade undergoing it last.
- There are some factors in the vineyards that can control the onset of veraison, limited water stress and canopy management that creates a high “fruit to leaf” ratio can encourage veraison.
- This is because the vine is biologically programmed to channel all its energies and resources into the berries, which houses its seeding offspring, so that they may have a better chance of survival.
- Conversely, very vigorous vines with lots of leaf shading for photosynthesis and water supply will delay the start of veraison due to the vines energies being directed towards continued shoot growth of new buds.
- For the production of high quality wine, it is considered ideal to have earlier veraison.
- During this period the cane of the vine starts to ripen as well changing from green and springing to brown and hard.
- The vine begins to divert some of its energy production into its reserves in preparation for its next growth cycle.

AFTER HARVEST

- Between September and October in the northern hemisphere, and between February and April in the southern hemisphere.
- In the vineyard, the antepenultimate event is the harvest in which the grapes are removed from the vine and transported to the winery to being the wine making process.
- The time of harvest depends on a variety of factors-most notably the subjective determination of the ripeness.
- As the grape ripens on the vines, sugars and pH increase as acids (such as malic acids) decrease.
- Tannins and other phenolics also develop which can affect the flavors and aromas in the resulting wine.
- The threat of detrimental weather and vine diseases can also play a role in the time table.
- The balance of all these factors contributes to when a winemaker or vineyard manager decides that is is time to harvest.
- Following the harvest, the vines continues the process of photosynthesis, creating carbohydrate reserves to store in the vine’s roots and trucks.
- It will continue doing this until an appropriate level of reserves have been stores.
- At that point the chlorophyll in the leaves begin to break down and the leaves change color from green to yellow.
- Following the first frost the leaves begin to fall as the vines starts to enter its winter dormancy period.

WINTER DORMANCY

- November to January in the northern hemisphere, and May to June in the southern hemisphere.
- Leaves fall of the vines, shoots lignify (harden and become brown) and the plant does into a dormancy stage until spring.
- In locations with very mild winters, the vine may fail to become dormant, and ‘winter’ pruning will take place while sap is still being supplied to the lignifying shoots.
- The following spring, the cycle beings again.

IMPORTANCE

- From a yield, and therefore quality, point of view, the most important stages in the growth cycle are:
- Floral initiation:
    - Where embryonic flowers develop in the dormant bug the year preceding bud burst. Successful floral initiation depends on temperature and sunlight exposure and there being sufficient carbohydrate reserves in the wood.
- Bud bust:
    - Vines are very sensitive to late spring forests at this stage, as these will destroy the shoots. If this happens, secondary bugs can grow, but these are much less fruitful.
- Flowering:

    - In order for fruit set to occur, ovules must be fertilized. Pollen must germinate on the stigma (female part of the flower) and grow a long tube to reach the egg and ovary. This requires adequate temperatures and can be disrupted by rain.
- Fruit set:
    - The failure of berries to set (or fertilize) is often referred to by it's French name, coulure.
- Shoot growth:
    - This must be in balance with the yield in order to enable optimum berry ripening.
- Berry ripening:
    - This must happen in sufficiently high temperatures for the physiological process to occur, but not too high, or the wine produces can lack fresh flavors and complexity.