Growth Cycle of the Vine

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1. Growth Cycle of the Vine
	1. **Budburst**
		1. Time: April/May (Northern Hemisphere), Sept/Oct (S. Hemisphere)
		2. Definition: When buds “burst” into leaf and cluster groupings. Stimulated by warmer weather (50 Degrees F +)
		3. Details:
			1. Carbohydrates stored over winter in roots return to the trunk and canes as sap to provide nutrients for budburst.
				1. If vine was winter pruned, the cut canes will start to bleed, sometimes up to 5 liters (1.3 gal) of water
			2. Bud burst is dependent on soil temperature as well as air temperature.
				1. Fast-warming soils heat roots more quickly and lead to earlier bud burst. Also, should buds burst early, low-moisture, sandy soils help prohibit frost damage because less water is present in vine tissue. Sandy soils tend to warm more quickly than clay soils, thus leading to an earlier commencement of the growing season.
			3. Buds comprised of 3 primordial shoots, each less fruitful than the one before
		4. Danger: Vines sensitive to late spring frosts. If they’re destroyed, secondary buds grow, but these are less fruitful
	2. **Rapid Shoot Growth**
		1. Time: May to August (N) and Oct to Jan (S)
		2. Definition: When shoots grow rapidly following emergence of leaves, which provide energy needed to accelerate growth.
		3. Details:
			1. In warmer climates, shoots can grow about 3 cm per day

 4. Dangers:

1. If soil is too dry, stressed vines will use even less water. This can limit shoot growth and important physiological functions. Equally, poorly-timed deficit irrigation applied too early in the season can impact on nitrogen uptake and photosynthesis and thereby impair vine functions, including bud development and flowering processes
2. Premature frost can damage shoots
	1. **Flowering**
		1. Time: April/May in the northern hemisphere, Sept/Oct (S)
		2. Definition: When flower clusters appear and self-pollinate to form berries.
		3. Details:
			1. Usually occurs 40-80 days after budbreak
			2. Occurs when average daily temps stay between 15-20 C (59-68 F)
			3. Self-pollination occurs (male stamens, female ovaries), and each fertilized flower becomes a berry with 1-4 seeds
				1. At the beginning of the flowering process the only part this is visible is the fused cap of petals known as the calyptra.
				2. Shortly after the calyptra is shed, liberating the pollen from the anthers of the stamen.
				3. Wind and insects play only a small role in aiding pollination, with the process being mostly self-contained within the vine.
				4. 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.
			4. Buds that will become next years crops begin to form.
		4. Dangers:
			1. Detrimental weather (wine, rain) can severely affect the flowering process, causing many flowers not to be fertilized and produce a group.
			2. Cross-pollination
	2. **Fruit Set**
		1. Time: May (N), November (S)
		2. Definition: When a fertilized flower begins to develop a seed and grape berry to protect the seed
		3. Details
			1. Very critical for wine production since it determines the potential crop yield.
			2. Not every flower on the vine gets fertilized, with the unfertilized flowers eventually falling off the vine.
				1. The % of fertilized flowers averages around 30% but can get as high as 60 or be much lower
			3. Grape berry size depends on the number of seeds
				1. 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.
				2. This can be caused by vine disease such as fan leaf, or by a boron deficiency in the vine. (Gewurztraminer and the Chardonnay clones 1A and Mendoza are both prone)
		4. Dangers
			1. Coulure (aka Shatter): 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 (Malbec, Grenache prone to this)
			2. Millerandage: occurs when some fertilized flowers do not form seeds but only small berry clusters
	3. **Berry Growth and Veraison**
		1. Time: End of July into August (N), end of January into February (S), normally 40-50 days after fruit set
		2. Definition: The colors of the grape take form-red/black or yellow/green and, in a process known as *engustment*, the berries start to soften and enlarge as they build in sugars. Is the beginning of the berry ripening process
		3. Details:
			1. Within six days of the start of veraison, the berries begin to grow dramatically as they accumulate glucose and fructose and as acids begin to fall.
			2. Berries grow to about half their final size when they enter the stage of veraison
			3. The color changes due to the chlorophyll in the berry skin being replaced by anthocyanin (red grapes) and carotenoids (white grapes).
			4. At this time, vine begins to divert some of its energy production into its reserves in preparation for its next growth cycle.
			5. Possible to control the onset of veraison
				1. Limiting water stress and canopy management (creating high “fruit to leaf” ratio) encourages veraison 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.
			6. The onset of veraison does not occur uniformly among all berries
				1. Typically, the berries and clusters that are most exposed to warmth (on 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
				2. 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.
	4. **Wood Ripening (aka Lignification)**
		1. Time: September to November (N), Feb-April (S)
		2. Definition: The cane of the vine starts to ripen, changing from green and springy to brown and hard
		3. Details: Carbohydrates are stored in the canes, trunk, and roots to provide energy for the following spring
	5. **Berry Ripening/Harvest**
		1. Time: Sept-November (N), Feb-May (S)
		2. Definition: Sugars increase, acids decrease, tannins and other phenolics develop, and grapes removed from vines and transported to winery for winemaking.
		3. Details:
			1. Time of harvest is subjective and depends on determined ripeness and balance of acid, sugars, and phenolics
		4. Dangers:
			1. Moderate/dry weather important before harvest as fruit susceptible to disease
			2. Pests also see change in fruit color, want to consume berries
			3. Vine diseases can delay or affect ripening
	6. **Post Harvest/Winter Dormancy**
		1. Time: Oct to January in the northern hemisphere, and April to June in the southern hemisphere.
		2. Definition: Leaves fall of the vines, shoots lignify (harden and become brown) and the plant goes into a dormancy stage until spring.
		3. Details:
			1. Following harvest, photosynthesis continues in plant, creating carb reserves that are stores in roots/trunk, continues until enough carbs are stored
			2. Vines prepare for cold weather by decreasing level of water in various tissues with the process of dehydration through movement of water to intercellular spaces, and accumulating sugars and protein complexes that bind water and serve as cryoprotectants. In that way, cell content won’t form damaging ice crystals (and freeze) in cold temperatures.
			3. During dormancy, vines continue to respire in order to maintain basic metabolic functions
		4. Dangers:
			1. 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.
			2. In locations that get very cold during winter, there’s risk of vine death