Fruit and Wine growing in UA

BUGI Team

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Fruit growing

Fruit can be grown in most parts of the country, although some crops are hardier and more tolerant of wetter conditions than others ('easy' crops include culinary apples, blackcurrants, blackberries and hybrid berries).

The ideal site should be

Sunny (preferably in full sun, but most crops can tolerate partial shade).

Sheltered from strong winds.

Not in a frost pocket (where cool air collects in hollows).

Not where fruit has been grown before.

The ideal soil should be

Well drained and at least 45cm (18") deep.

Fertile – with at least 10% organic matter content.

Loam (or sandy-loam, clay-loam mix). Poor, light, shallow or heavy soils can be improved with bulky organic composts and manures to improve depth, structure, moisture retention/drainage and fertility.

Slightly acidic pH (between 6.0-6.5 for most crops).

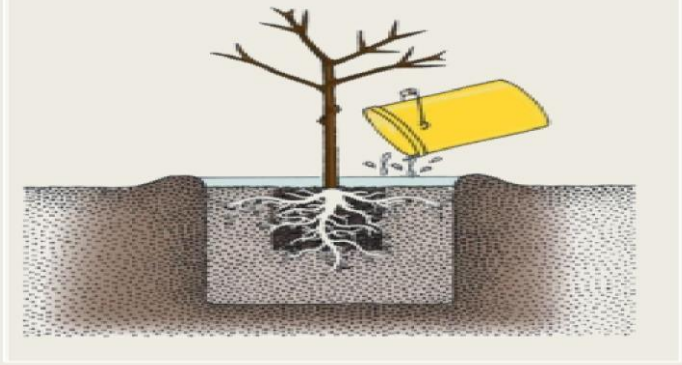
Free of perennial weeds before planting.

Planting

If you order your fruit trees, bushes or canes from a specialist fruit tree nursery, they will usually arrive as bare-root plants (without soil, but wrapped in damp peat and protective sacking, or damp roots in a polythene bag) during the dormant season (November to March).

Plant them as soon as possible after they arrive, but if the soil is too wet, dry or frozen, keep the plants in a frost-free place and keep the roots moist to prevent them drying out. Before planting, the roots can be soaked in a bucket of water for an hour.

Container-grown fruit trees, canes and bushes can be bought all year-round and could be planted at any time, provided soil conditions are suitable. Give the plants a good watering an hour or two before you plant them, to help prevent the roots drying out.



Steps for planting fruit trees:

1. Choose a suitable site

2. Mark out the exact positions where the trees, canes or bushes are to be planted.

3. Prepare the soil at least a month in advance if possible, digging it over thoroughly to break it up. Dig a large hole (about a square metre in size), digging down until you come to a lighter layer of subsoil. Dig over the surface layer of subsoil lightly to help break it up a bit, working in a layer of garden compost. Making a slight mound at the bottom of the planting hole will help position bare-root trees better – giving them something to 'sit on'.

Steps for planting fruit trees:

4. Remove any weeds or large stones.

5. Bang in a sturdy supporting stake (if required), driving it in firmly so that it doesn't move around. Bare-root trees should have the stake driven straight in vertically, placing it on the side of the prevailing (south-west) wind.

6. Place your tree into the planting hole, turning it until you are happy with its positioning. The stem of the tree should be set about 8cm away from the stake. Trees to be grown as cordons will need to be positioned at an angle. Do not plant too deeply – the graft union between the rootstock and the upper portion should be well above the surface level of the soil.

7. When you have filled the planting hole give it a final firm, then make a shallow depression around the base of the tree to form a water-retaining basin, which will help water soak into the rootball. Give the tree a good water-in. Using a tree tie, secure the tree to the stake (positioning the tie near the top of the stake).

Growing in containers:

Study task

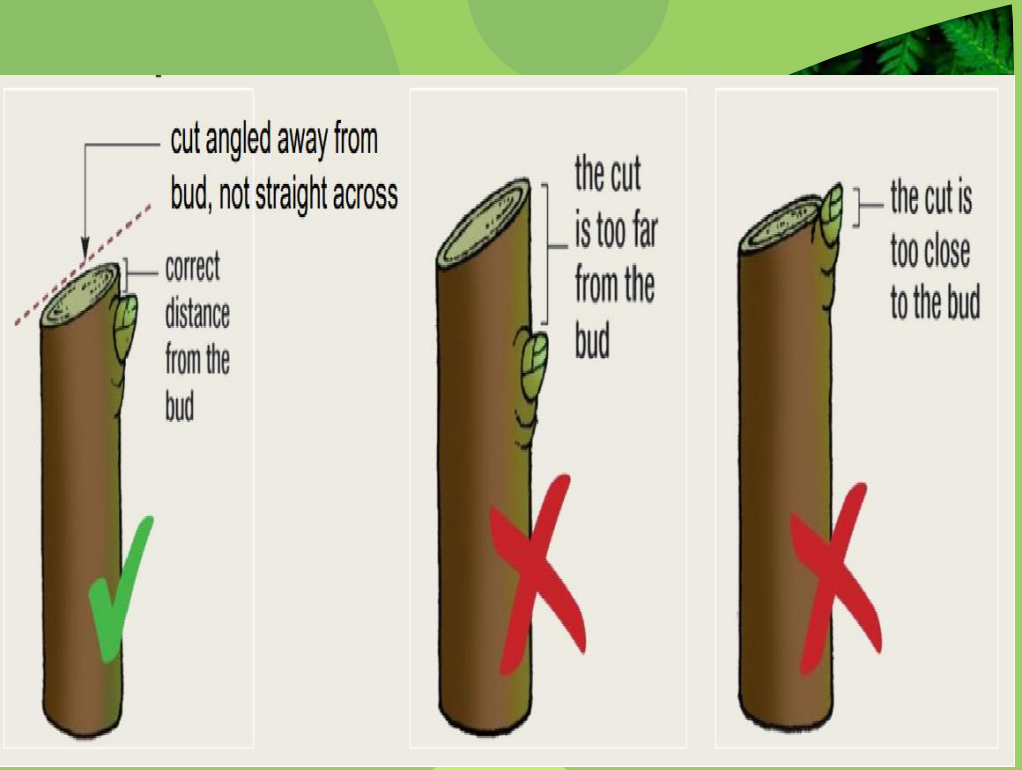
1) 30-40cm container of wood, plastic, or terracotta with a layer of crocks or gravel in the base for drainage and a
filling of planting mix (use a heavy multi-purpose compost, mixed with topsoil and garden compost).

2) Water the pot regularly (daily in hot weather) and feed every two weeks during the growing season with a high potash feed (tomato food is good). Do not allow the pot to become waterlogged – place the pot on bricks to help drainage if necessary.

3) If your potted trees produce a lot of fruit, you will need to remove some of it to prevent the branches breaking (it is best to thin out the fruitlets (immature or baby fruits) in June, before they get too big
4) Protect terracotta containers from frosty weather during the winter – either by moving to a shed or greenhouse or by wrapping in sacking or bubblewrap, otherwise they will shatter.

Pruning

When to prune?
- In winter when trees are dormant, to prevent damage
from frost (from end July to end August).
- In summer only to remove damaged/diseased
branches, water sprouts and suckers



Pruning

The main aims of pruning are to encourage the production of more fruiting wood, and to remove unwanted growth.

1) Use sharp secateurs and try to make a clean cut with no rough edges.

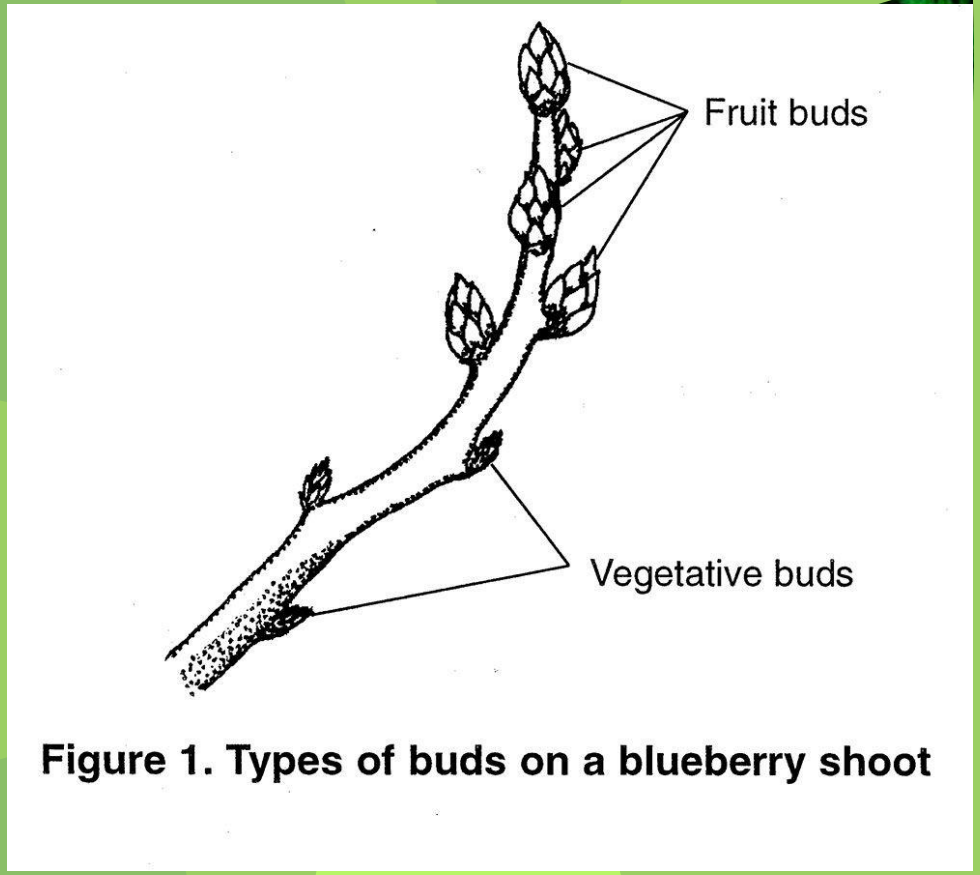
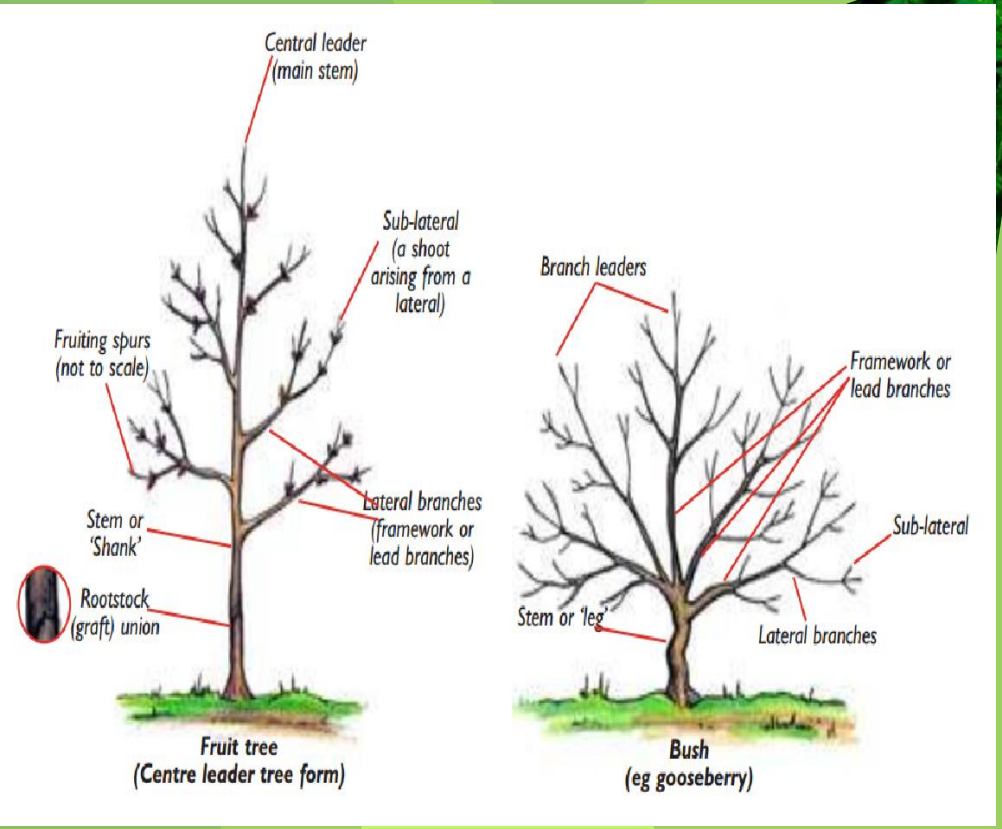


Figure 1. Types of buds on a blueberry shoot

Pruning

2) When pruning, make a slanting cut just above an outward- or upward-pointing bud. If you are pruning back to a vegetative (shoot) bud, a new shoot will develop in the direction that the bud is pointing.
3) Make sure you prune at the right time of year, according to the type of fruit you are growing. Most pruning is carried out during the dormant period (November – March), but summer pruning may be required on a number of crops (particularly trained fruit trees) to remove unwanted growth.

Pruning



4)On fruit trees, you can tell fruiting wood apart from new wood as the fruit buds along it are rounder and fatter than vegetative buds – this is most noticeable in March, when the buds begin to swell – so if you are unsure, leave pruning until then.
5) Prune out any dead, diseased or damaged wood whenever you see it – this helps prevent the spread of diseases.

Pruning

Always cut away any branches growing below the union of grafted trees. This is the root stock growing through and it will compete with the fruit growing part of the tree.

Branches good for fruiting are at angles of 45-65 degrees off the main branches. Branches with smaller angles tend to break in high wind.

Preventing and reducing pests and diseases the organic way

- Fruit can be trickier than other crops to grow organically since the trees, bushes and canes are in the same piece of ground for a long time (often 15-20 years or strawberriesmore) and, with the exception of, crop rotation is not an option.
- Suitable site
- Clean and healthy planting material
- Fertile and healthy soil (don't overfeed)
- Encourage beneficial insects (by growing flowering annuals or wildflowers near fruit, with beetle banks and bug boxes)
- Encourage other beneficial wildlife

Preventing and reducing pests and diseases the organic way

- Keep the base of fruit plants weed-free. Weeds can act as host plants for pests, diseases and viruses, as well as competing with the plants for water and nutrients.
- Use varieties with resistance or tolerance to specific pests and diseases.
- Prune regularly, to encourage strong growth, new wood and open the plant up to light and air, helping foliage dry quickly after rainfall.
- When watering, try to water the soil around the base of the plants (rather than watering the foliage), so that leaves stay dry.
- Pick fruits before they become over-ripe and more susceptible to pest and disease attack.
- Keep fruit trees, canes and bushes clean by removing dead and diseased plant material and damaged or infected fruits.
- Try not to over-feed plants with fertilisers (especially those high in nitrogen) as this can encourage soft, sappy growth which is more prone to pest and disease problems.

PEACHES

TIME	MOST COMMON PESTS AND DISEASES	CONTROL
Bud swell	Peach leaf curl, mildew	Milk spray for mildew
After flowering	Bollworm, aphids	Pepper/garlic spray
Mid December	Rust, mildew	Milk spray
Before ripening	Fruit fly	Pepper/garlic spray
Autumn (leaf fall)	Mildew, leaf curl	Organic milk spray
Dormant season	Scale	Vegetable oil spray

APPLES

TIME	MOST COMMON PESTS AND DISEASES	CONTROL
At flowering	Mildew	Milk spray or lime sulphur
Late November	Codling moth	Pepper/ garlic spray
Mid December	Codling moth, aphids bollworm	Pepper/ garlic spray
End January	Codling moth, fruit fly	Pepper/ garlic spray for soft bodied insects
Mid January	Fruit fly, codling moth	Pepper/ garlic spray for soft bodied insects
Dormant season	Scale	Vegetable oil spray or lime sulphur

Apples

There are over 2000 varieties of apple, but you will usually only see a handful of varieties in the shops.

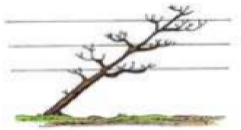
There are two main types of apple – dessert varieties which are eaten fresh and culinary or 'cooking' apples which are generally large in size and very sharp if eaten raw and need to be cooked before eating

Some varieties of apple are ready for harvest as early as late July, but most will be ready for picking in September or October.

All varieties of apple will set a better crop if pollinated by at least one other different variety. A few, such as Bramley, require two. Growing a good mix of varieties will help, but if you are limited to just a few, choose varieties which have the same or adjacent pollination groups (flowering periods).

If your tree is consistently producing blossom but no fruit, you may need to consider adding another variety or two.

There are many different ways in which apple trees may be trained and pruned resulting in the eventual form they take and amount of space they occupy. However, even in the tightest of spaces, apples can be grown as compact columns, cordons or as small bushes in containers.

Tree form and planting distance between trees		Description
Compact column Planting distance: MM106 – 60cm (2ft)		Easy to grow, especially where space is tight. Forms a single stemmed, upright tree. Suitable for lawns, tubs, borders and hedging. Choice of varieties is limited. May require staking in exposed areas. **No pruning required!**
Step-over Planting distance: M27 – 1.5m (5ft) M9 – 3m (10ft)		A very attractive and old fashioned method of growing apples as an edging for a bed or border. A single-tier espalier is grown along a wire support 25-30cm (10-12") above ground level. Summer pruning required.
Cordon Planting distance: M27 & M9 – 0.75m (2.5ft) M26 & MM106 – 1m (3ft)		Ideal for growing several varieties in a small area. Trees are planted at a 45° angle against a supporting structure (eg tier of wires, wall or fence). Summer pruning required. Makes an attractive feature.
Espalier Planting distance: M9 – 3m (10ft) M26 – 3.5-4m (11.5-13ft)* MM106 – 4-4.5m (13-15ft)*		Attractive and traditional method of training – although requires more space than a cordon or step-over. Ideal trained against wires on a wall or fence. Tiers of branches 50-60cm (20-24") apart are trained to run horizontally from the main trunk. Summer pruning required.
Bush Planting distance: M27 – 1.5m (5ft) M9 – 3m (10ft) M26 & MM106 – 3.5m (11.5ft)*		A very popular and easy-to-manage tree form. Trees have a short trunk with a rounded but open canopy (like a tea cup). Winter pruning required. Staking required for trees on M27 and M9 rootstocks.
Half standard Planting distance: M26 – 5m (16ft) MM106 – 6m (20ft)		Ideal for traditional orchards with large trees needing plenty of space. Makes a large crowned tree with a trunk length of just over 1m (3ft). Difficult to care for properly. Winter pruning required.
Standard Planting distance: MM106 – 7m (23ft) M2 & MM111 – 8-9m (26-30ft)*		Very large and tall trees with a trunk height of around 2m (6.5ft). Good for grazing sheep underneath, or establishing a wildflower/wildlife area but very difficult to care for properly. Winter pruning required.

** Use the wider recommended spacing for trees on vigorous rootstocks or fertile soil*

Most apple varieties are spur bearers – producing fruit buds on short, stubby shoots called 'spurs' which develop on two to three year-old wood. However, a few are tip bearers, or partial tip bearers, producing all or most of their fruit buds at the very tips of the branches. Be careful when you are pruning tip-bearing varieties not to cut off all the shoot tips, or you will not have any fruit in the following years!

First winter (after planting)

After planting a maiden tree in winter, prune back the main stem to a bud just above the level of the supporting wire.

First summer (after planting)

In late summer, select and tie in two new s[illegible] to horizontal positions along the wire. Remo[illegible] other shoots.

Common pest problems

Distorted (curled and twisted) young leaves and shoots

This is usually caused by aphids (greenfly). Your first defence is encouraging natural predators such as ladybirds and lacewings into the area; For spot treatments through the season, use soft soap (insecticidal) sprays, and products made from natural oils or plant extracts.

Young leaves folded together and webbed

The culprits here are usually larvae (caterpillars) of tortrix moths (Archips podana and Adoxophyes orana) which feed on shoots, leaves and fruits, often webbing foliage together for protection whilst they graze. Caterpillars emerge in late March and April and are active until June, before pupating and emerging as adults several weeks later. Remove and squash the offending caterpillars when seen!

A pheromone trap* hung on the tree from May onwards will help trap male tortrix moths and prevent them mating with the females, which will reduce caterpillar numbers the following year.

Curled/distorted leaves caused by rosy apple aphid (Dysaphis plantaginea) (inset - rosy apple aphids)

Tortrix larva and webbed foliage

Pheromone traps are useful for trapping male moths of several pest species

Common pest problems

Caterpillars within the apples

The classic ‘maggot in the apple’ is the codling moth larva (Cydia pomella). Adult moths are active from May until August, laying eggs on developing fruitlets which then hatch and the resulting larvae burrow into and feed on the apple. Attacked fruits can be removed and destroyed when seen during the growing season (particularly where the caterpillar is still active inside). Usage of pheromone traps*

Corky, ribbon-like scars on fruit, and sticky brown frass near a small hole

This is characteristic damage caused by apple sawflies (Hoplocampa testudinea) – the larvae of which burrow beneath the skin of developing fruitlets, resulting in the formation of scars on the fruit surface (which becomes most obvious on mature fruits), before burrowing into the core of the apple to feed on the pips, sometimes causing premature fruit drop. During the growing season, the presence of larvae in the fruit can be more easily detected by the wet, brown-black frass exuding from a small hole in the fruit. adult sawflies are particularly attracted to apple varieties which have very bright, white blossom (such as Discovery) – so one method of control is to hang white sticky traps on the trees during warm weather in spring to help trap flying adults, although other insect species may also be caught.

Common disease problems

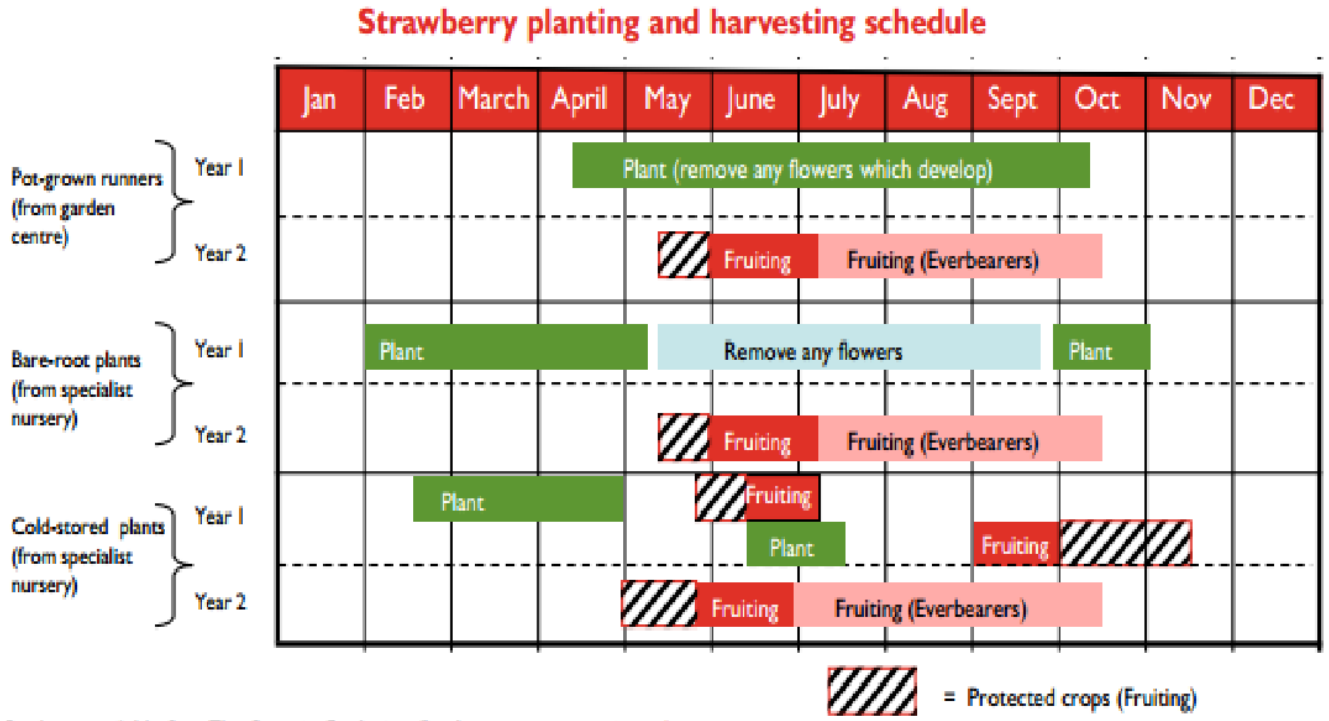
-Brown spots on leaves and fruit (*Venturia inaequalis*)
-White powdery deposits on leaves and stems (*Podosphaera leucotricha*)
-Brown blistered and corky lesions on the stems (*Nectria galligena*)

-Brown cavities within the apples - 'bitter pit' – which arises as a result of a shortage of calcium and water

-Leaves brown and wilting - shortage of water

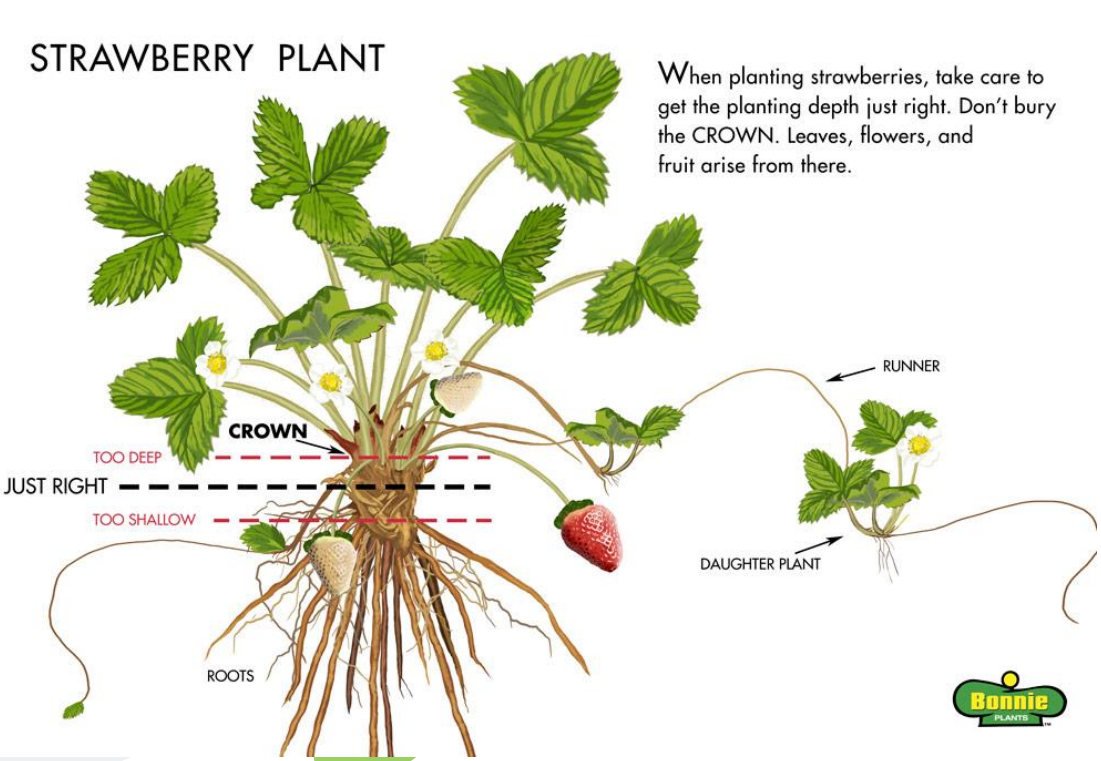
-Poor growth - competition from neighbouring grasses and weeds

Strawberries



Products available from The Organic Gardening Catalogue - www.organiccatalogue.com

There are two main types of strawberry – summer fruiting (June-bearers) which crop in June and July, and everbearing strawberries, which produce fruit in several flushes from late June through to autumn, with peak production during July and August.



Plant bare-root plants as soon as possible after they arrive, or heel in to a sheltered, temporary place if the ground is not workable. Soak the roots of bare-root strawberry crowns in water for an hour before planting if possible, and water potted plants well before you transplant them. Set the plants about 30-40cm apart. The crown of the plant should be positioned level with the soil surface (slightly exposed), but with no roots visible. (Be careful not to bury the crown too deep or it will soon rot).

Care

Care during the year

Keep the plants well watered during the growing season, but try to avoid getting too much water on the developing fruits, which can encourage diseases such as *botrytis*. Remove any unwanted runners which develop (baby plants produced on long shoots) by cutting these right back to the base of the plant. Once the fruits begin to ripen, place a mulch mat, bark chippings or straw beneath the plants to prevent the fruits becoming dirty – this will also help suppress weeds. Watch out for pest and disease problems and take appropriate action where necessary

Propagating your own plants

Once your plants are well established it is easy to raise more plants from them – as long as your original 'mother' plants are healthy, pest and disease-free. You will notice that the plants start to produce long trailing stems (stolons) in late summer. At the end will be a tiny plant (a runner), which may already show some roots. When these have three or four leaves, peg each into a small 8cm (3") pot filled with multi-purpose compost.

Leave it attached to the 'mother' plant until the new runner has rooted into the pot. It can then be cut free from the 'mother' plant and grown on in its pot before transplanting to a new growing site the same autumn or in spring the following year.

Common pest problems

Slugs and snails

Unfortunately, organic mulches such as straw and chippings can encourage them, as they provide an ideal dark, damp hiding place during the day. Most feeding damage occurs at night, but short of a night-time vigil to remove and squash the offenders, they can be dealt with relatively easily with home-made beer traps or proprietary traps.

Twisted and distorted (sometimes sticky) foliage

The culprits here are aphids, which can often be troublesome as there are a number of aphid species which attack strawberry plants. The aphids secrete a sticky honeydew substance as they feed, spoiling the foliage and fruits and encouraging ants and the growth of sooty mould. Early treatment of pest hot spots is essential - rub off or remove infested shoots and leaves, use biological control agents* or encourage natural predators by growing wildflowers nearby. Insecticidal soap* can be used as a last resort.

Common pest problems

Speckled, dry, crispy leaves which fall prematurely

This is usually caused by spider mites which are tiny (0.5mm) mites feeding on the foliage of strawberry plants. Sometimes, leaf edges may curl too. There are two species which can be a problem on strawberry; two-spotted spider mite (*Tetranychus urticae*) and tarsonemid mite (*Phytonemus pallidus fragariae*). Several naturally-occurring predatory insects (eg predatory mites *Typhlodromus* and A*mblyseius* and the predatory midge *Feltiella acarisuga*) exist which can help to control mite populations naturally – encourage these by growing a good mix of wildflowers nearby. Badly infested plants should be removed altogether.

Notches in leaves, plants wilting and detaching from roots

The likely culprits here are vine weevils (Otiorhynchus sulcatus), which are a common pest of many plants, but have a particular fondness for strawberries.

Common disease problems

-White powdery coating on leaves, which curl slightly, turning purple-red (*Sphaerotheca macularis*)

-Rotting fruits which are covered in a grey powdery substance (*Botrytis cinerea*)

-Misshapen fruits (bugs such as the tarnished plant bug (*Lygus rugulipennis*) and common green capsid (*Lygocoris pabulinus*).

Urban wineries

- While you could say that urban wineries are having their moment, sprouting up all across the country, urban vineyards remain extremely rare.
- Ever more expensive land, poor soil, and soot filled air
- As craft and farm-to-table movements continue to grow in popularity, the appeal of the urban vineyard is rising. Many of these urban vineyards, tucked away in some of the world's most famous cities, were recently built (or rebuilt), while others have survived for centuries, as urban sprawl has penned them in.

Clos Montmartre - Paris

Clos Montmartre - Paris

- Founded in the 12th century and run by the inhabitants of Montmartre, it brings together several wine names, "Le Clos Berthaud", "La Goutte d'Or" and "Il Piccolo".
- Montmartre is home to what is arguably the world's most famous urban vineyard – Clos Montmartre. Replanted in 1932, decades after phylloxera had ravaged a vineyard on the site which belonged to a Bendectine Abbey (destroyed during the French Revolution), the new vines of Gamay and Pinot Noir were the work of local artists, who sought to preserve the area from urban development.

MAZZORBO ISLAND, VENICE – VENISSA

MAZZORBO ISLAND, VENICE – VENISSA

- At the height of its power, Venice was home to countless vineyards, which supplied the Doges with their drink of a choice, Dorona, a golden-hued white wine. When a decade-long search turned up a few remaining Dorona vines, which were believed extinct, the Venetian government partnered with the Bisol family to replant an abandoned vineyard on the island of Mazzorbo.
- The winemakers claim the salty water (and air) helps create a uniquely Venetian terroir, while warding off diseases.

ENFIELD, LONDON
FORTY HALL VINEYARD

ENFIELD, LONDON FORTY HALL VINEYARD

- Forty Hall Vineyard is the newest addition to Forty Hall Farm, a civic-minded project run by North Londoners to promote local, organic food.

QUEENS, NEW YORK CITY
QUEENS COUNTY FARM MUSEUM WINERY

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QUEENS COUNTY FARM MUSEUM WINERY

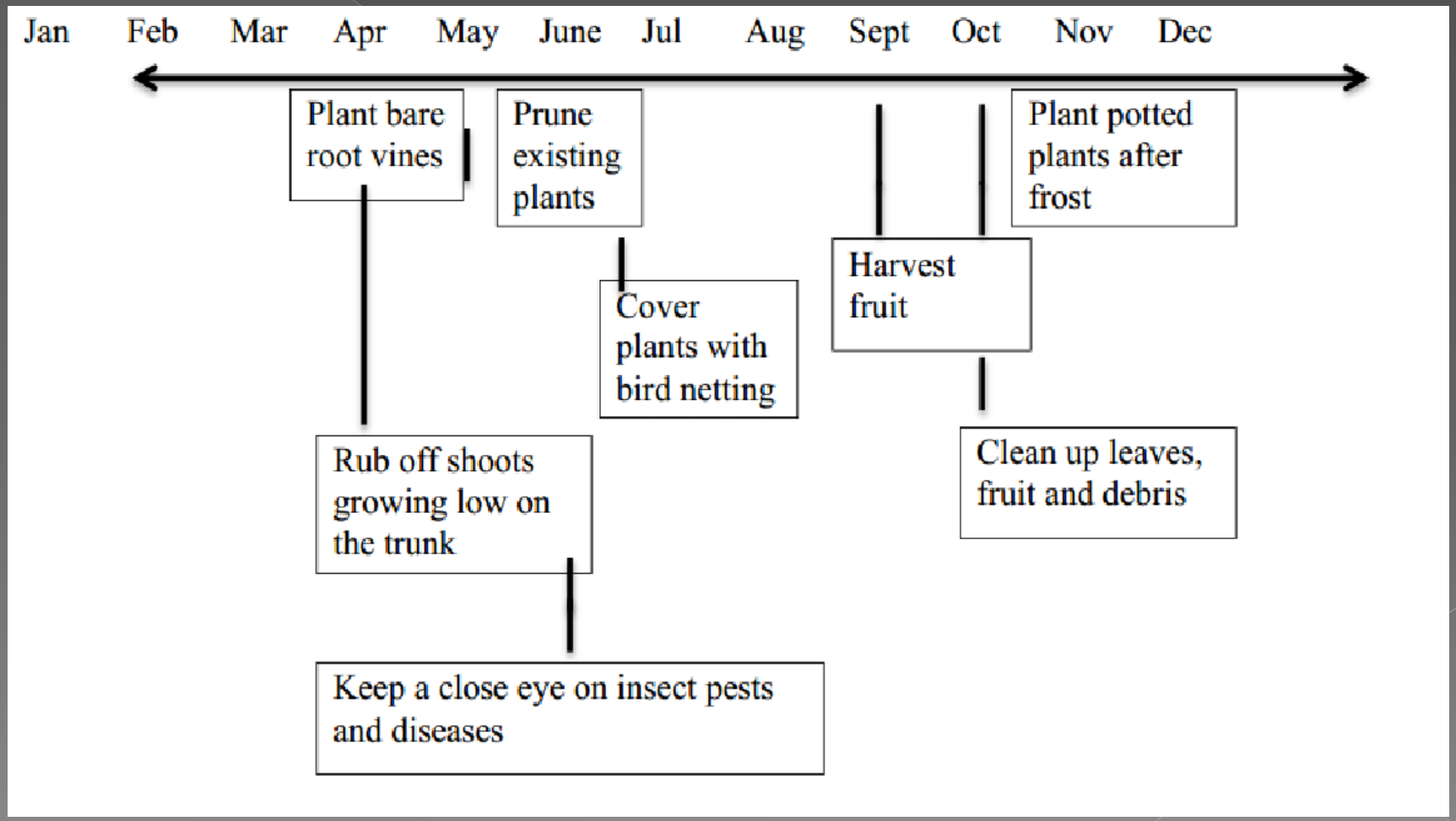
- The Queens County Farm Museum's Winery is part of New York City's largest remaining tract of farmland (47 acres), a place where crops have been grown since 1697.
- The earliest vintage, a 2006 Cabernet Franc blend, has been followed up with Chardonnay, Cabernet Sauvignon and Merlot.

ECHO PARK, LOS ANGELES – D'AUGUSTINE VINEYARD

ECHO PARK, LOS ANGELES – D'AUGUSTINE VINEYARD

- This self-described 'tiny vineyard' (strictly non-commercial) in the heart of Los Angeles is planted over entirely with Syrah, which produce 500 pounds of grapes in a good year.

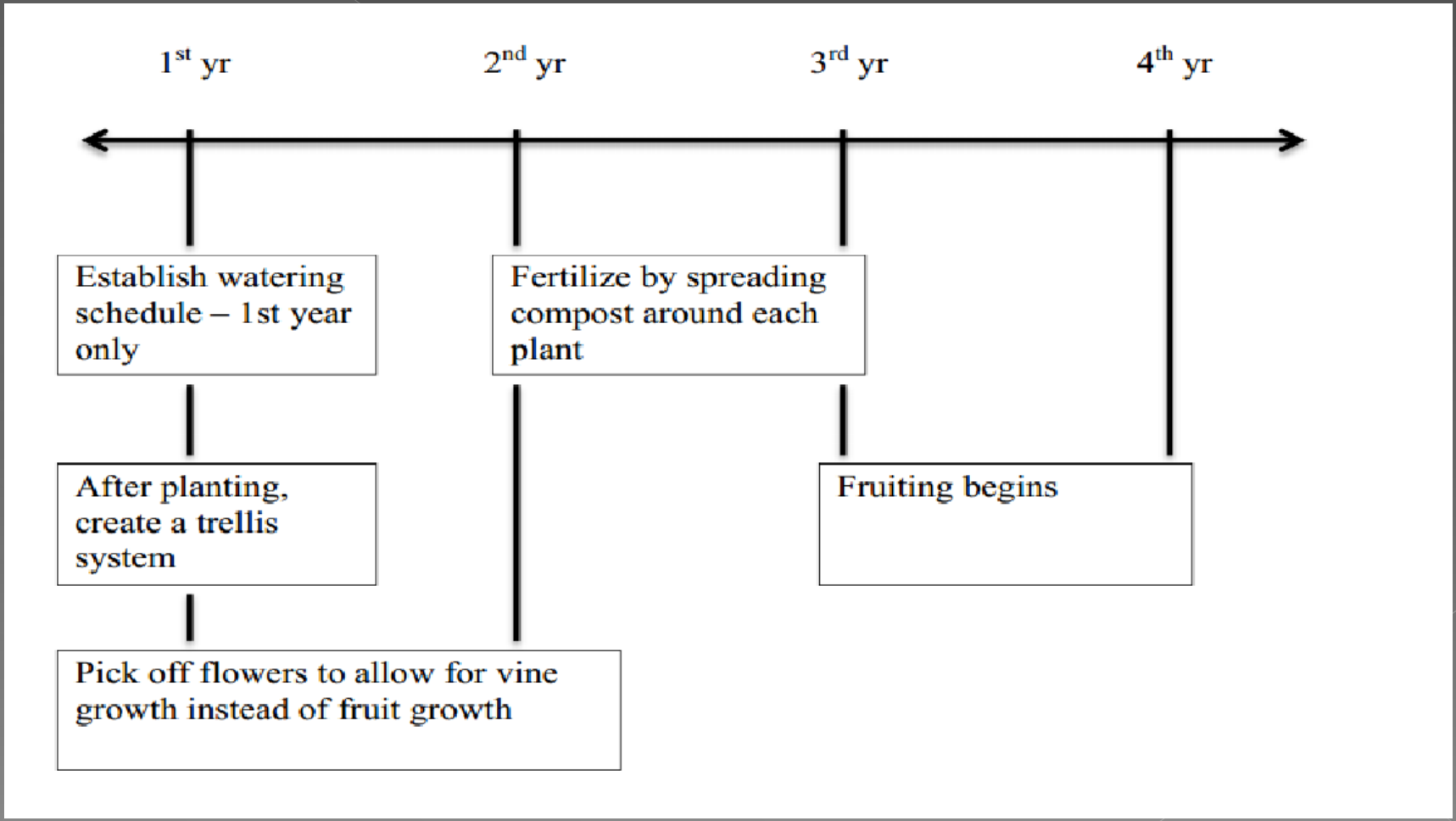
Production timeline for old and new plantings



Production timeline for old and new plantings

- Keep them in a cool place before planting and don't let the roots dry out; plant bare root plants as soon as the soil can be dug up. Before planting (spring planting is recommended), soak the plant roots in water for 3-4 hours. Then, remove all canes except the most vigorous, spread the roots out into a hole in the ground, and plant with the lowest bud on the plant just above the surface of the soil. For potted grapevines from a local nursery, plant after the threat of frost is gone. Establish a regular watering schedule throughout the first year. Sandy loam is the best soil to grow grapes because it drains well and holds enough nutrients. In a greenhouse, the soil type would be one of the easiest parts to manipulate. A pH of 5.5 to 7.0 is recommended for grapes, and good drainage is key.

Production timeline for first four years of planting



Production timeline for first four years of planting

- Since it takes a considerably larger amount of time to grow grapevines from seed, it is most common to take hardwood or softwood cuttings for propagation. However, after stratification (a period of time where seeds are exposed to cold temperatures to break down substances that keep the seeds dormant), seeds can be planted directly in the ground or in pots in a greenhouse.

Key aspects of grape cultivation

Grape growing is limited by certain climatic conditions:

- A reasonably long growing season (150–180 days) with relatively low humidity (less than 800 mm per year) but sufficient soil moisture is necessary.
- The temperatures from April to September are crucial for reaching good development of the vine and ripening of the fruits. When temperatures are below 10 °C, vines are dormant. The optimum temperature is between 25 and 30 °C. Temperatures higher than 38 °C will stop growth.
- Frosts (–1 °C and lower) occurring after vine growth has started in spring could kill off most of the fruitful shoots and reduce the harvest to nil.
- Variations in the microclimate, location and topography of individual vineyards contribute to the diversity of wines and their respective quality

Key aspects of grape cultivation

Grapes can be produced on a number of soils – fertility is not as important as soil structure:

- Sandy or gravelly clay loams are most desirable; differing soil attributes are reflected in wine diversity.
- Alkaline soils must be avoided.
- Good drainage is very important.

Key aspects of grape cultivation

Parameters for growing grapes (depending also on whether they are used for making wine, raisins or as table grapes) include:

- spacing of vines in uniform rows for easy cultivation;
- propagation through cuttings, buds or grafts (propagation from seeds is only done for producing new varieties);
- planting, usually of one-year-old vines of desired fruiting variety and with sufficient vine support for satisfactory vine growth;
- pruning and thinning, the removal of vegetative parts to establish and maintain the vines in a form that will reduce labour, facilitate cultivation, help control insects and diseases, expedite harvesting and improve quality; and
- cultivation and irrigation, depending on climate topography and soils.

Most common diseases

- **Pierce's Disease (*Xylella fastidiosa*):** Insects feed on a plant and transmit the bacteria inside the plant, where it travels through the xylem vessels and spreads the infection. Infected vines appear stressed, with leaves turning red or yellow in the summer, berries shriveling, and dead and dried leaves falling off the vine.
- **Phylloxera (*Daktulosphaira vitifoliae*):**Phylloxera are microscopic insects that suck sap and feed on the leaves and roots of grapevines. The roots become deformed and fungal infections occur there, which blocks the flow of nutrients and water to the vine.
- **Downy Mildew (*Plasmopara viticola*):** This fungi vine disease can destroy grapes and vine vegetation. Between mid-May and late autumn, the aerial parts of the plant can become infected, particularly when the temperature is below 18°C. The symptoms are oil spots and a moldy cover or bright green spots found on the leaves. A white moldy cover is also found on the shoots and the inflorescences. The infection can also reach the berries, particularly the thriving ones, and cause them to dry out and look like raisins. They may also soften and turn a violet-brown color.

Most common diseases

- **Powdery Mildew (*Uncinula necator*):** All aerial parts of the plants can get infected by this disease. Development happens through the entire growing season until late fall. It favors dry years and climates with low humidity and little rainfall. Moldy coats on leaves, inflorescences, and rachis are telltale signs. Berries can become infected in the early stages of their development, with a gray coat covering them and then they dry out afterwards. Infected half-ripe berries usually crack and dry out. The plant's canes can also become covered with a gray coating with gray-brown spots underneath.
- **Grey Mold (*Botryotinia fuckelina*):**Fruit crops and aerial parts of vine organs are susceptible to grey mold or botrytis. This disease can strike at any time throughout the year. Rainy conditions and overly fertilized vineyards can cause the botrytis to appear. The first signs of the disease are spots on leaves that turn brown and begin to rot. The leaves then die, dry, and fall off the vine. Inflorescences can also rot and dry out. On berries, the most devastating effect of the disease is when the fruit becomes covered with the grey mold and begins decaying.
- **Black Rot (*Guignardia bidwellii*):**All aerial parts of the plant can become infected with this disease. The fungus grows in warm and humid environments between mid-June and late August. There are first round brown spots on the leaves and the shoots, which die and become dried out. The fungus then reaches the berries while they are still developing. Reddish brown to gray spots appear and then they lose their moisture and shrink into raisins that are brown-black or black-blue in color and have black dots.
- **Vine Trunk Diseases:**Two grapevine diseases in this category, Petri disease and Esca (black measles), are caused by fungal pathogens. They tend to affect old vines that are at least 10 years old but young vines are not immune. Wood and leaves that have contracted these diseases develop unusual discoloration patterns of stripes or sports. The leaves, and then the stems, eventually shrivel in the middle of growing season and grapes end up falling to the ground. The vine then suffers sudden death, which could happen within days after the initial symptoms appear. The likelihood of these grapevine diseases occurring is highest in dry weather that follows after a wet season.

Most common diseases

Sustainable Vineyard Establishment and Management

Introduction

- Overriding Principals of different systems
- Conventional Viticulture
- Integrated Viticulture
- Organic Viticulture
- Biodynamic Viticulture
- Sustainable Winegrowing New Zealand

Overall

- Any practice or set of practices used in the vineyard should utilise the philosophy of the growers and suitable production systems to produce the best fruit possible for the desired style of wine within the constraints of the system without marginalising the environment

Definitions

- Conventional Practices; those practices which are more traditional and considered "standard" in an industry - generally include use of synthetic chemical controls.

- Integrated / Sustainable Production; those practices which include monitoring and thresholding before acting, and minimise use of synthetic chemical controls.

Definitions

- Organic Production; those practices which involve 'soft' chemicals, and encouraging biodyversity using natural ecosystems.

- Biodynamic Production; those practices which involve holistic biodyverse systems using indigenous materials in a closed system.

‘Conventional’ Viticulture

- Prior to advent of synthetic “chemical” pesticides / herbicides / fungicides, viticulture was simple – practices were largely cultural
- 1950’s onward saw rise in “chemical” controls to “improve” fruit quality
- Calendar spraying became the “conventional” method of practicing viticulture
  - The application of chemical controls at regular intervals regardless of need.
  - This can be an unnecessarily expensive high input system.
  - Both fruit and environment can be loaded with heavy metals (impact of residues on concentration)

The term "Chemical"

- Be careful using the term "chemical" loosely;
  - WATER IS A "CHEMICAL" (H_2O)
  - Sports drinks are 100% "chemicals"

  - All chemicals are toxic
    - <u>It just depends on concentration ingested</u>
      - Tiny conc. of methanol (approx. 6mL)
      - Medium conc. of ethanol (approx. 500mL)
      - Massive conc. of water (9L/day)

Chemicals....

NUTRIENT	AVERAGE QUANTITY PER SERVING (250ML)	AVERAGE QUANTITY PER 100ML
ENERGY	479kJ	192kJ
PROTEIN	0g	0g
FAT, total	0g	0g
- saturated	0g	0g
CARBOHYDRATE	25.9g	10.4g
- sugars	25.9g	10.4g
SODIUM	280mg	110mg
GUARANA EXTRACT	300mg	120mg
COMPOSITION INFO		
Caffeine	78mg	31mg
Riboflavin	1.2mg	0.49mg
Niacin	7.2mg	2.9mg
Vitamine B_6	1.1mg	0.46mg
Vitamine B_{12}	1.4µg	0.57µg
Panthothenic acid	1.8mg	0.7mg
Taurine	1000mg	400mg
Glucoronolactone	63mg	25mg
Inositol	50mg	20mg

Organic Production

- Essentially "conventional" as this was main management system before synthetic chemicals
- Normally uses;
  - Biological control agents (ecosystem encouragement)
  - Monitoring / Thresholding
  - Cultural controls
  - Some 'organic' spray preparations
  - Much manual labour

Cultural Controls

- Canopy Management
  - Wire-lifting – Arranges shoots appropriately, lowers leaf-layer-number.
  - Leaf-Plucking – Opens up fruiting zone, assists with aeration and maturation.
  - Shoot Thinning – Lowers canopy density, aids in vine balance.
  - Trimming (sides and top) – Opens up entire canopy, controls vegetative balance.
- Weed / Inter-row Management
  - Mowing
    - Lowers frost risk, lowers competition with vines.
  - Flaming
    - Mainly used for weed removal.
  - Cultivation
    - Used in the control, and rotation of inter-row plants.

Cultural Controls

- Pruning and Training
  - Trellising systems – open up canopy, aid in light penetration.
  - Training methods – control vine balance, vegetative output.
- Inter-row Management
  - Mowing
  - Cover Crop
  - Cultivation
- Site Selection / Preparation
  - Row Spacing, Vine Spacing
  - Row Orientation
- Vine / Rootstock Selection
  - Different cultivars, clones differ in vigour, resistance.
  - Need to suit soil, environment, management, goals

Organic Pest Control

- Akin to Chemical – Insect lifecycle focus
- Monitoring of Huge importance
  - Organic controls are not instant!
  - Thresholds of acceptability
  - Planning and action are essential
- Cultural, Biological, Some approved Sprays
  - "Surround", Pyrethrin, Insecticidal Soaps.
- Controls often include removal of infected / damaged tissue
  - Grape Berry Moth, Grape Cane Girdler

Organic Disease Control

- Noticeably different from Chemical, similar to IPM. – Monitoring
- More cultural controls available cf Pest cntrl.
  - Canopy Management – Openness, airflow, light.
  - Cluster Thin, Shoot Thin.
  - Leaf-Pluck – Severity, Region.
- "Air" Sprayer – Dry canopy after rain.
- Some Sprays "Organic"
  - Lime Sulphur, Copper

Varietal Suitability for Organic Management

- Some vines have genetic predisposition to resist a host of pests and diseases.
  - Selection of these can aid organic management
- Vine Suitability also affected by Climate suitability, growth habit, Genetics.....
- Vines Best Suited to Organic Management are not often those desired (fashionable) for winemaking
  - *V. vinifera* are very fussy and generally have high susceptibility to diseases
  - More vigorous *V. riparia, V. labrusca, V.amurensis* more suitable, hardy and disease resistant, often used for rootstocks.

Organic & Conventional Viticulture Head to Head

- ORGANIC
- No Chemicals
- Strict Monitoring
- Cultural Controls #1
- More Costly per Litre
- Strict Inter-row Mgmt.
- Some Health Benefits
- Non-Specific Market.
- Almost Residue Free
- More Expensive

- CONVENTIONAL
- Many Chemicals Avail.
- Calendar Spraying
- Chemical Spray #1
- Family Friendly ($$$)
- Mown Grass and Herb.
- Subtle Health Benefits
- Normal Marketing
- Some Residues Detect.
- Less Expensive

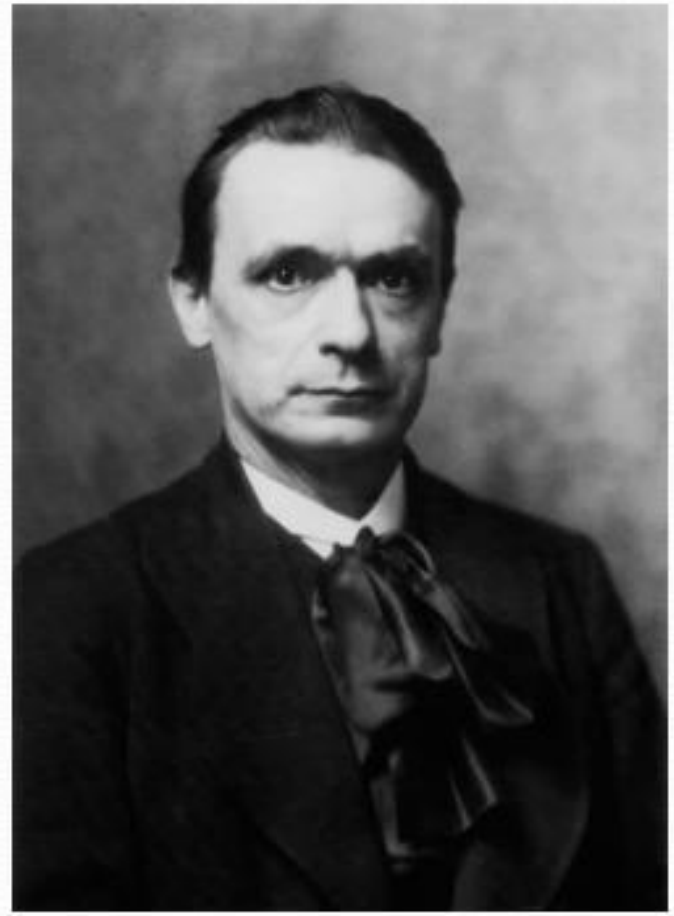
Wine Quality – Organic or not?

- Tinttunen & Lehtonen (2001). Distinguishing Organic v's Conventional by Phenol content and Spectral Data.
  - 58 Wines, French and German, Organic and Conventional, Red and White.
  - Organic Wines had higher levels of gallic acid (phenol)
  - *Trans*-resveratrol conc. was higher in organically produced wines.
    - *Trans*-resveratrol has antioxidant and antifungal properties
      - Organic wines have some health advantages over their conventional counterpart – more detailed work remains.

Biodynamic production

- The truest expression of terroir (its not all about skipping around cow horns during a full moon!)
- Biodynamic systems utilise;
  - Materials indigenous to the site
  - A ‘closed system’
  - Diverse ecosystems
  - Natural biological control agents

Biodynamic Production
-The Rudolf Steiner story



Biodynamic Production
-The Rudolf Steiner story

- Rudolf Steiner (1861-1925) was born in Austria
- He worked in the realms of consciousness and cognition
- A university student of mathematics, science and philosophy in Vienna, he later earned a doctorate from the University of Rostock
- Authored nearly 30 books and 6000 lectures
- Initiated biodynamic farming/gardening


NEW ZEALAND SUSTAINABLE
WINEGROWING

Sustainable Winegrowing New Zealand (SWNZ)

- Sustainable Winegrowing New Zealand was established by volunteer grapegrowers in August 1995 as an industry initiative directed through New Zealand Winegrowers.
- Sustainable Winegrowing New Zealand was commercially introduced in 1997 and has been adopted by growers from all the grape growing regions.
- The introduction of a winery program in 2002 has been a significant development.

SWNZ

- **Sustainable Winegrowing New Zealand was developed to:**
  - Provide a "best practice" model of environmental practices in the vineyard and winery.
  - Guarantee better quality assurance from the vineyard through to the bottle.
  - Address consumer concerns in matters pertaining to the environment and winegrape production.

(http://www.nzwine.com/swnz/)

SWNZ

- SWNZ aims to deliver the following benefits to its members:

  - A framework for viticultural and winemaking practices that protect the environment while efficiently and economically producing premium winegrapes and wine.

  - A format of continual improvement to ensure companies operate with a goal of improving their operational practices.

  - A vehicle for technology transfer so that companies are kept informed of new technology and its application.

  - An audit structure that has integrity and rigour to comply with market expectations.

  - Opportunity to be a part of the positive future for New Zealand grape growers and winemakers.

Plant production in greenhouses

The specific selection of a greenhouse location must take into account a variety of factors:

Topography -the location must be flat in width direction, with a slope in the main axes between 0 and 0.5 percent, and never over 1–2 percent, as this would require terracing.

Microclimate - it is essential that the local topography is suitable for effective drainage of cold air during calm nights. Frequently foggy areas should be avoided. Areas that are well illuminated and free from shadows are preferable.

Irrigation-Many areas have been abandoned due to the lack of water in sufficient quantities and of acceptable quality (salinity) in the Mediterranean Basin.

Drainage – Places with a high water table must be avoided.

Soil characteristics - Whether cultivation is directly in the soil or in pots or containers, the soil must have properties appropriate for horticultural crops.

Pollution-For greenhouses located in urban areas, air pollution conditions must be evaluated, not only in terms of incidence on the plants themselves, but also with regard to residues deposited on the greenhouse, which can limit solar radiation (e.g. dust from factories) or damage the greenhouse cladding material.

Availability of space

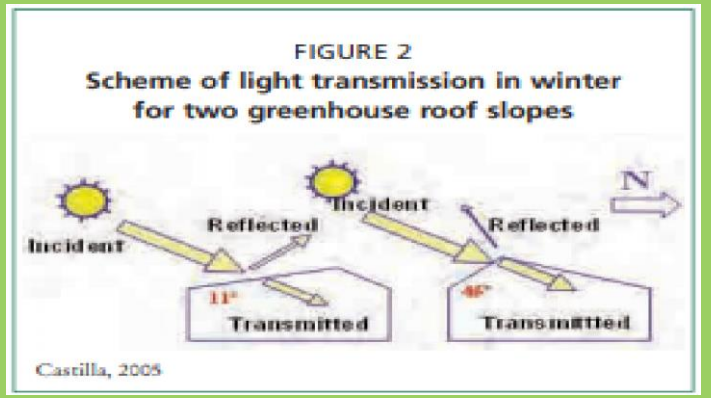
Availability of labour

Infrastructures

Orientation

Greenhouse design and covering materials

1. Local-type greenhouses: low-cost structures with little climate control besides natural ventilation; they are built with local materials (i.e. wood) and covered with polyethylene plastic film. The parral-type greenhouse is probably the most widely used in terms of surface area. They are very cheap but there are significant design-associated problems, such as lack of tightness, low radiation transmission in winter and, more importantly, lack of good natural ventilation. Therefore, in terms of light transmission, it is recommended to build the greenhouse with an E–W orientation. Nevertheless, light uniformity is better in N–S greenhouses since the gutter and ridge shadows change their position during the day as the Sun moves.



Greenhouse design and covering materials

2. Plastic-covered industrial-type greenhouses: A large number of different greenhouse structures may be included in this group (pitched roof multi-span, asymmetric multi-span, saw-tooth, curved roof multispan etc.). The arch-shaped multi-span system prevails among the industrial types, mostly clad with plastic film or, in some cases, with rigid or semi-rigid materials (preferably polycarbonate). While arch-shaped multi-span greenhouses have many advantages, they are not free from problems. Condensation can occur in the upper inner part of the roof, resulting in dripping in humid and cold weather, usually during the early hours of the day. Attempts have been made to solve this problem by increasing the roof slope with pointed arches instead of circular, but this has not entirely eliminated the condensation.

Greenhouse design and covering materials

3. Glasshouses: They usually have only roof ventilators, which may be discontinuous (e.g. Venlo type, one-side mounted windows) or continuous. The glasshouse area in southern European countries is limited, mainly because of the high investment costs.

Greenhouse design and covering materials

Greenhouse types – Conclusions and GAP recommendations

- Enhancing winter light transmission is an important good agricultural practice in Mediterranean areas: greenhouses must have a minimum roof slope of 25–30°.
- Local-type greenhouses, if properly designed, are suitable for mild climate areas. Their main advantage is their low investment cost; their principal disadvantage is the lack of climate control (mainly lack of ventilation).
- Avoid low roof slope greenhouses for better light transmission.
- If ventilation is of greater concern than light transmission, orient the greenhouse so that the

vents are open towards the prevailing winds.

- Choose E–W orientation if there is no conflict with ventilation.
- Crop rows must be N–S for optimum light uniformity.
- Industrial-type plastic-covered greenhouses can modulate unfavourable external conditions. While recommended over the local-type greenhouses, their cost-benefit analysis could be worse than for local-type greenhouses in the short term.
- Glasshouses are excellent greenhouse structures, but they are not popular in southern European countries, mainly because of the high investment costs.

Greenhouse design and covering materials

The most common polymers used in horticulture are low density polyethylene (LDPE), ethylene vinyl acetate (EVA) and ethylene butyl acrylate (EBA). These three polymers cover more than 80 percent of the world market. Other materials are also popular, such as PVC in Japan or linear low density polyethylene (LLDP) in the rest of the world. In comparison with glass, a property common to all plastic materials is their low density and therefore low weight. Additives are an essential part of the covering materials. They are dispersed between the chains of polymer molecules without interacting chemically. Additives are used to facilitate the manufacturing of the film as well as to improve its performance under field conditions; the type and quantity of additive depends on which properties of the covering material need improving. The two most common additives in horticulture are UV (ultraviolet) stabilizer additives and IR (infrared) absorbing additives. UV stabilizers absorb UV radiation or protect the polymer molecules. As a consequence, the film ages more slowly: indeed, the vast majority of plastic films in horticulture last more than one year and include UV stabilizer additives. Good greenhouse film should block long-wave IR radiation (wavelength 0.7–4 μm) so as to reduce heat loss.

Climatic requirements of vegetables

The most commonly grown species in greenhouses are vegetables with medium thermal requirements (tomato, pepper, cucumber, melon, watermelon, marrow, green bean, eggplant). The indicated species, traditionally grown in the warm season, are adapted to average ambient temperatures ranging from 17 to 28 °C, with limits of 12 ºC (minimum) and 32 ºC (maximum). They are sensitive to the cold and suffer irreversible damage with frosts. Daily variation between day and night average temperatures (thermal periodicity) is required for proper physiological functioning. These thermal differences are between 5 and 7 °C .

The minimum daily radiation requirements of these species are estimated at around 8.5 MJ m-2 day-1 during the three shortest months of year (November, December and January in the Northern Hemisphere; May, June and July in the Southern Hemisphere). This means around 6 hours of light per day.

Other desirable climate parameters for these species would be soil temperature of

> 14 °C and ambient relative humidity of 70–90% .

New crop analysis

Asparagus ** Short rest period; earliness; spear quality
Asparagus lettuce * Shortness of cycle; fibre content of the stem; low success rate with consumers
Bottle gourd *** Bulky plant; difficulties in crop management; fruit well accepted
Carosello * Disease susceptibility; earliness; irregular shape and size of fruits; good taste
Chinese cabbage *** Bolting, shortness of cycle; good taste; product well accepted
Okra * Low harvest index; frost susceptibility; narrow market; low productive level
Orach *** High yield level; short shelf-life; good taste
Pak choi ** Bolting; high yield level; high fibre content
Parthenocarpic tomato
and eggplant *** Setting at low temperature; irregular fruit shape and size
Radish ** Shortness of cycle; cracking of the roots; frequent pungency taste
Rocket ** Shortness of cycle; bolting; low fibre content
Snake melon *** Earliness; irregular fruit; no bitter taste
Sweet corn *** Irregular setting; bulky plant
Vigna spp. ** High cost of harvesting; short shelf-life
Water spinach ** Frost damage; high growth rate, good taste
Wild beet *** High-yielding; high mineral and vitamin content
Wild borage * High growth rate; high mineral and vitamin content
Wild cabbage * Bolting; high growth rate; high mineral and vitamin content
Wild chicory * Slow growth rate; resistance to bolting; satisfactory yield level and quality

* = poor; ** = fair; *** = good.

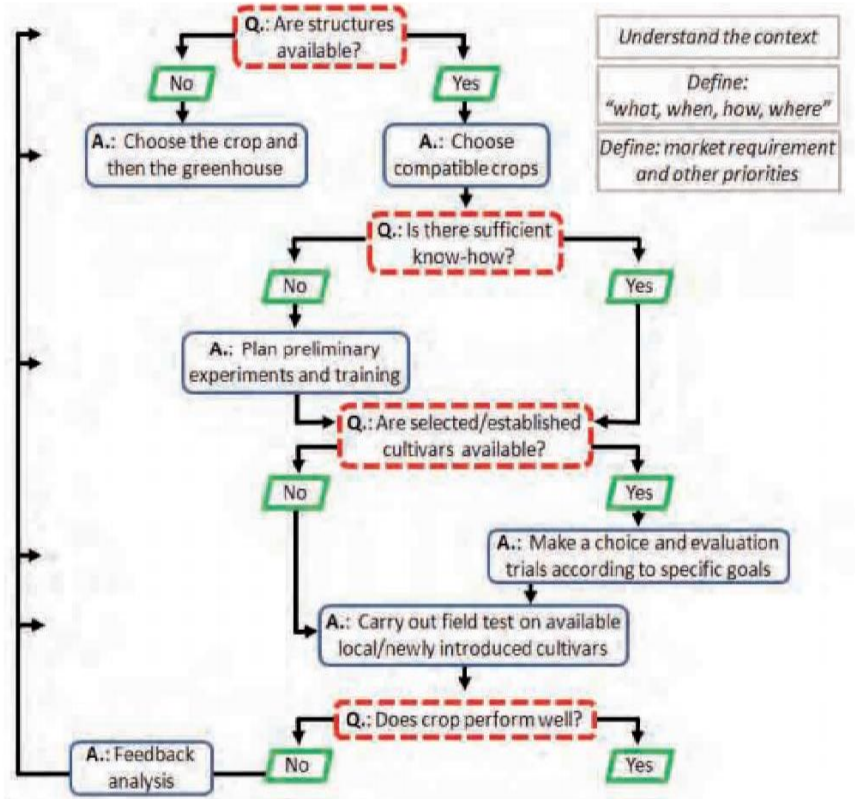
In summary new crops should:

- adapt to agroclimatic and social conditions;
- meet consumer requirements; and
- be marketable and profitable.

New crop analysis

FIGURE 1

Simplified flow chart summarizing the main steps for the choice of species and cultivar for protected cultivation



Q = question A = answer

Concepts of water-use efficiency :

1. Irrigation efficiency:

$$Ea = Et/Id$$

Ea is application efficiency
Et is evapotranspiration (potential Et or Et0)
Id is irrigation water delivered at the farmgate

Irrigation application efficiency (Ea) is the ratio in % of water delivered at the farmgate to the amount stored in the active root zone. This ratio can vary from extremely low values to values approaching 100 percent. However, in normal irrigation practices, the application efficiency of surface irrigation is about 60%, of well-designed sprinkler irrigation systems 75% and of drip irrigation up to 90%.

2. Water-use efficiency

WUE = yield per unit area/ water volume used to produce yield

Or

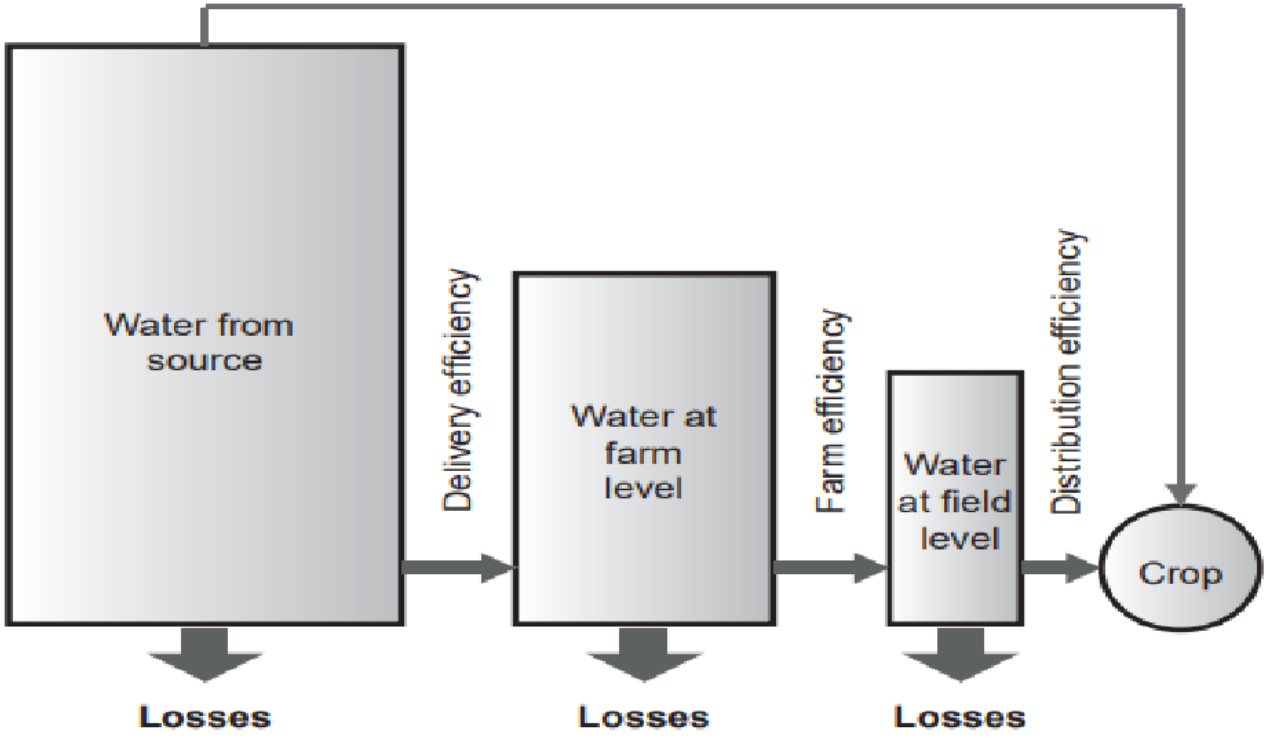
$$WUE = (N/T)/(1+(E/T))$$

E is evaporation
N/T is transpiration efficiency2
N is dry matter production
T is transpiration

Factors affecting water-use efficiency: Water delivery systems, Irrigation systems and water delivery systems, Crop shape and morphology, Climatic factors, Management, Economic consideration, Techniques for predicting yield, Social and political factors.

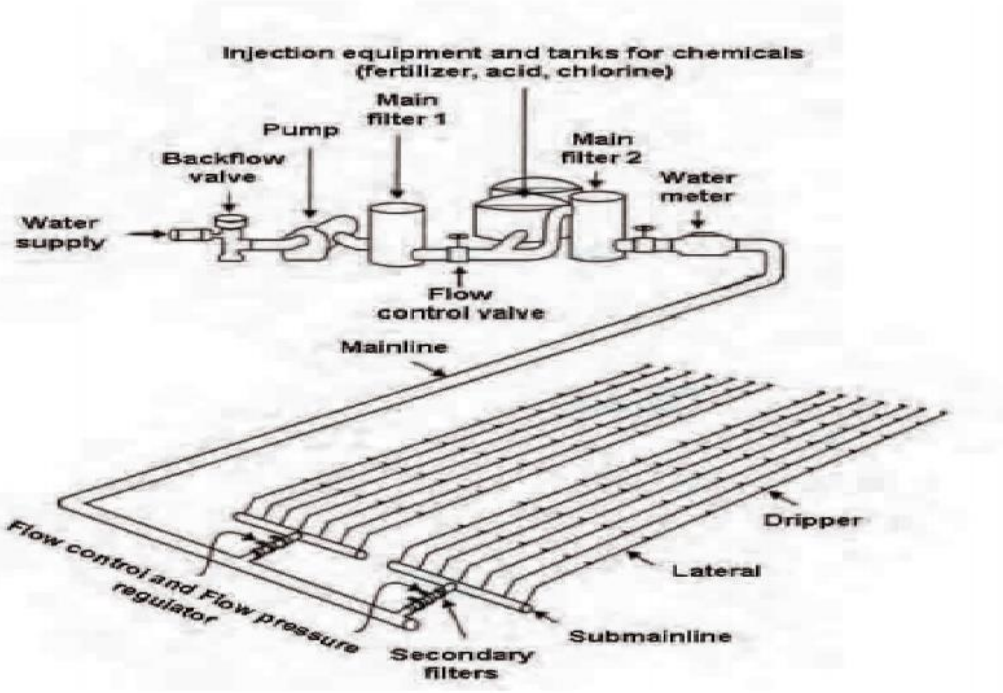
Concepts of water-use efficiency :

FIGURE 4
Overall irrigation efficiency



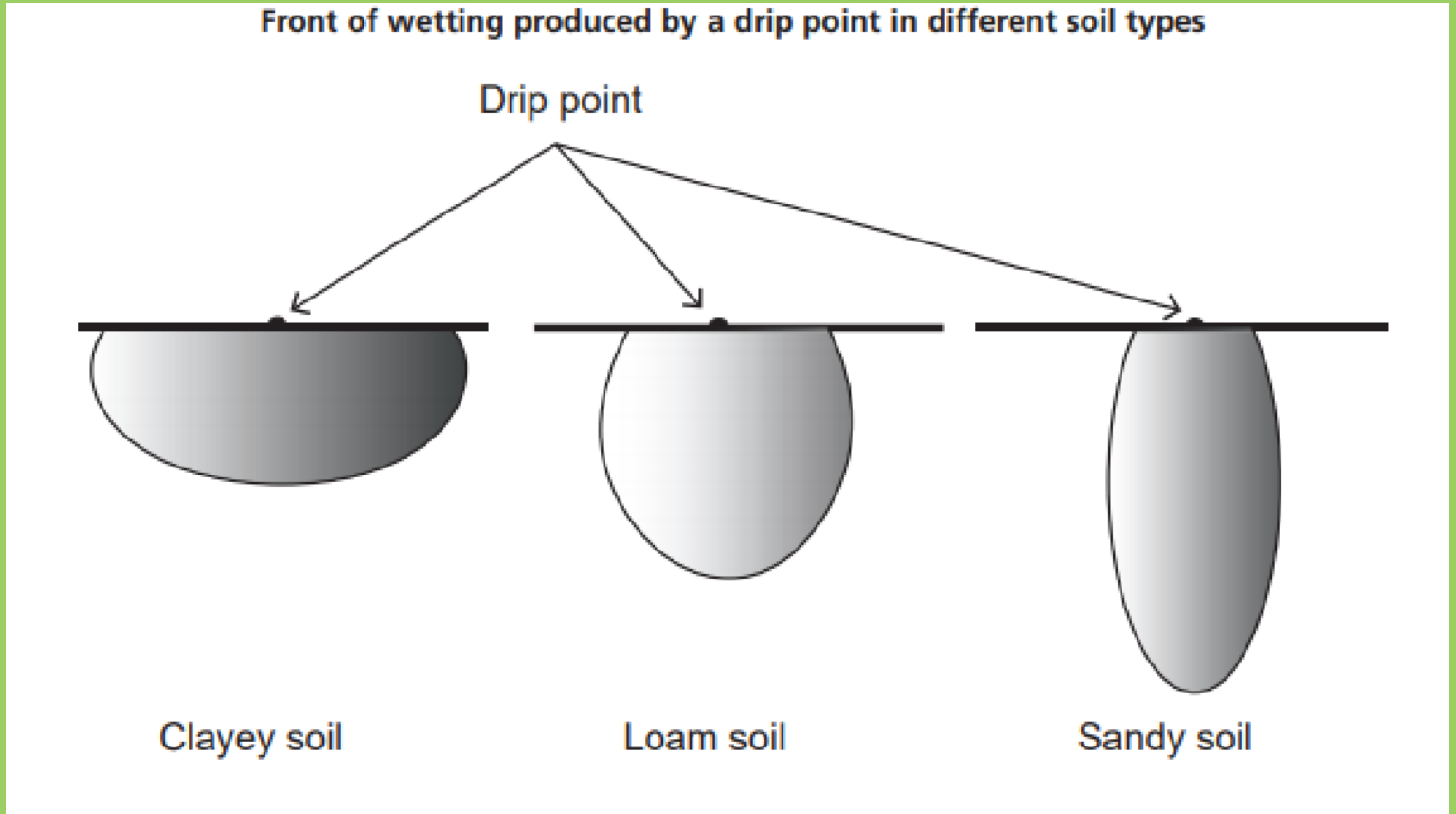
Microirrigation

FIGURE 3
A schematic microirrigation system



Eisenhauer *et al.*, 2002 (adapted)

Microirrigation



Soil organic matter (SOM)

Soil organic matter (SOM) is approximately 1–3% by weight and 12–15% by volume. It can be divided into three general pools:

1. living biomass of micro-organisms
2. well-decomposed organic matter
3. highly stable organic material

Surface crop residues are generally not included as part of soil organic matter.

When organic material is incorporated into the soil, some components (e.g. proteins) degrade quickly (in a period of weeks to months), while others (e.g. lignins) decay very slowly. This rather stable organic material is called humus and roughly corresponds to SOM.

SOM has a key role in both plant nutrition (release of nutrients, energy supply for soil micro-organisms, formation of the nutrient exchange complex) and soil structure (improvement of porosity and soil aeration, increase of water-holding capacity in sandy soils, limiting of compaction and erosion of heavy soils).

SOM is generally estimated indirectly as the result of the concentration of organic carbon times 1.724.

Rating	SOM (%)		
	Sandy soils (1, 2, 4) [a]	Loamy soils (5, 6, 7, 8) [a]	Clay and silty soils (3, 9, 10, 11, 12) [a]
Very low	< 0.8	< 1.0	< 1.2
Low	0.8–1.4	1.0–1.8	1.2–2.2
Medium	1.5–2.0	1.9–2.5	2.3–3.0
High	> 2.0	> 2.5	> 3.0

Soilless culture

Soilless culture can be defined as “any method of growing plants without the use of soil as a rooting medium, in which the inorganic nutrients absorbed by the roots are supplied via the irrigation water”.

FIGURE 1
Classification of soilless culture systems

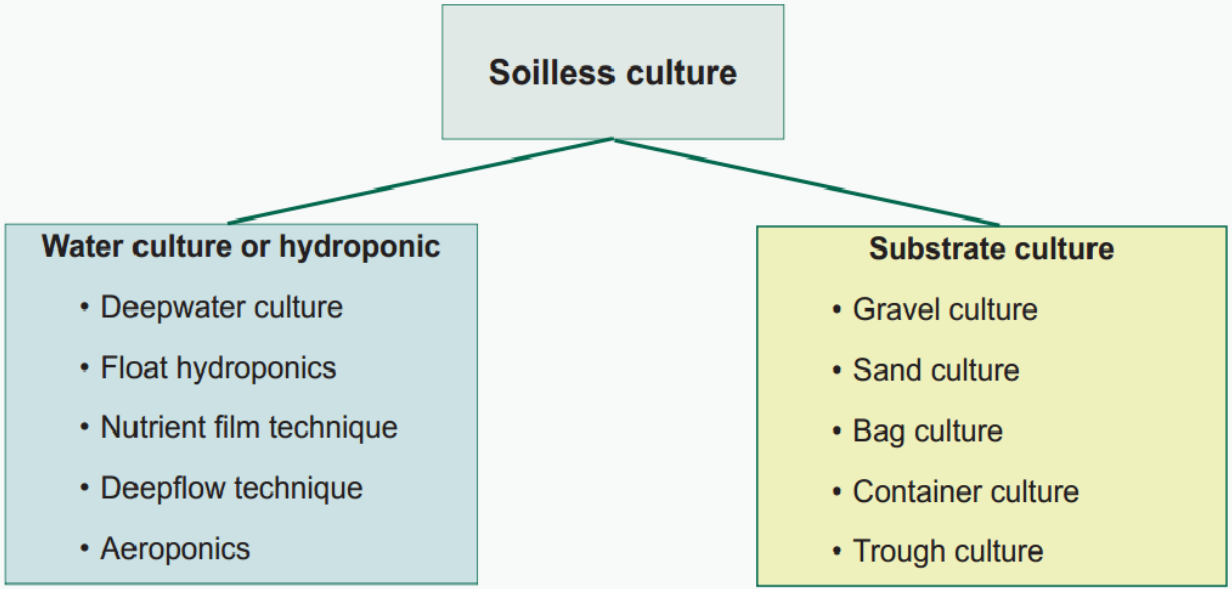
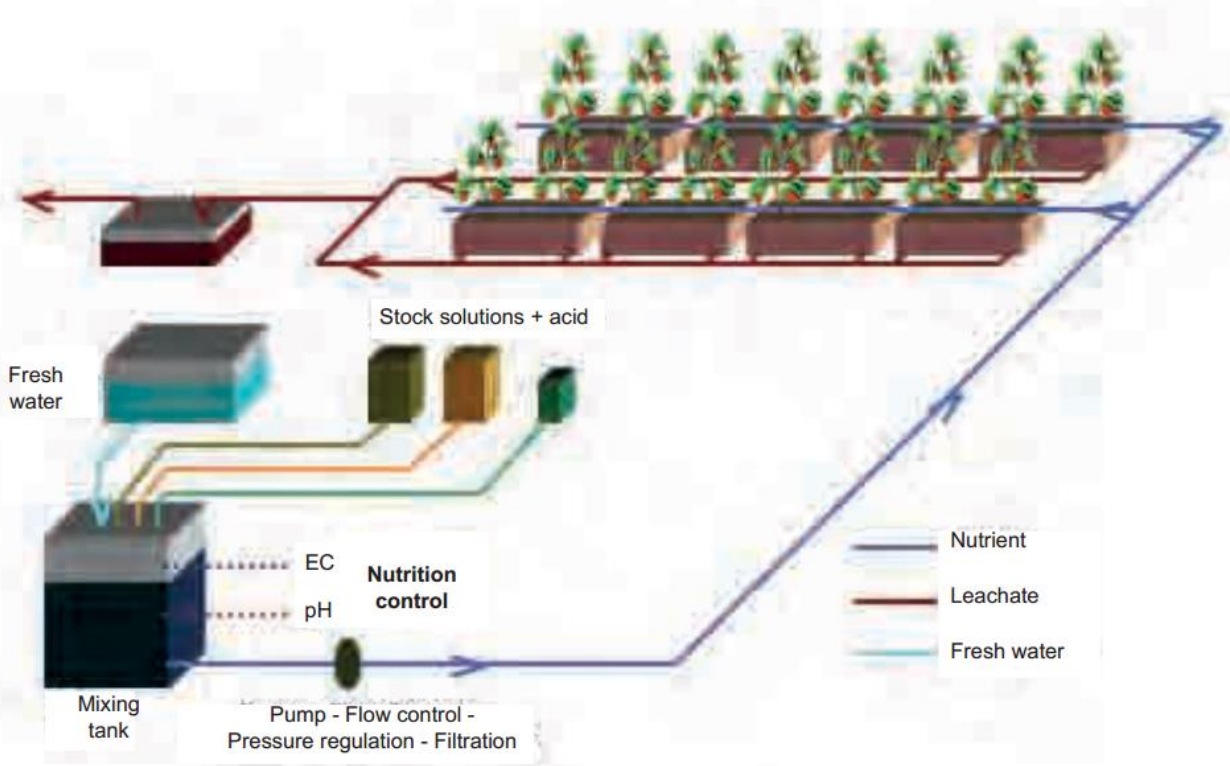


FIGURE 2

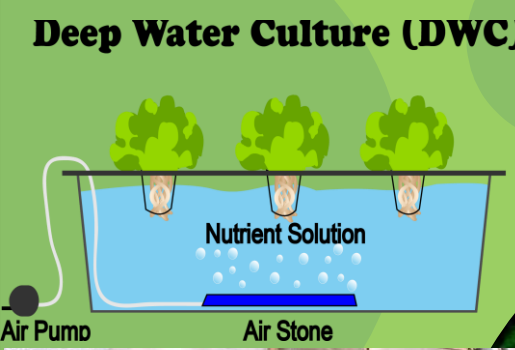
Open-loop soilless culture system



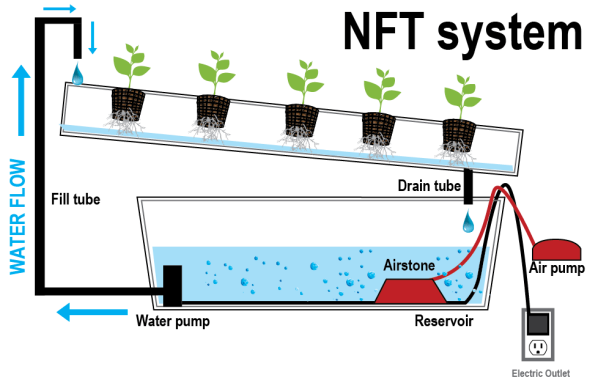
Standard Operational Practices, Ecoponics

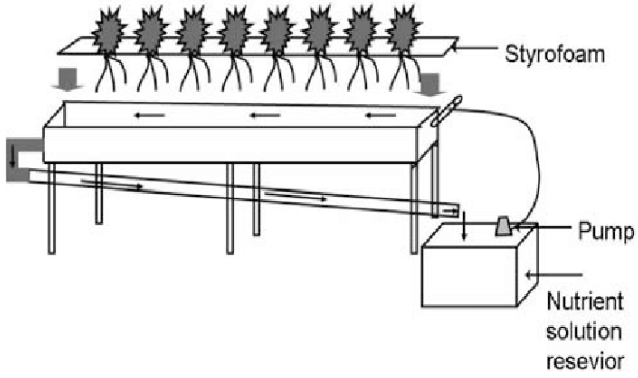
- Absence of soil-borne pathogens.
- Safe alternative to soil disinfection
- Possibility to cultivate greenhouse crops and achieve high yields and good quality, even in saline or sodic soils, or in non-arable soils with poor structure (accounting for much of the world's cultivable land).
- Precise control of nutrition, particularly in crops grown on inert substrates or in pure nutrient solution (also in soilless crops grown in chemically active growing media, plant nutrition can be better controlled than in soil-grown crops, due to the limited media volume pe plant and the homogeneous media constitution).
- Avoidance of soil tillage and preparation, thereby increasing crop lengt and total yield in greenhouses.
- Enhancement of early yield in crops planted during the cold season, because of higher temperatures in the root zone during the day.
- Respect for environmental policies (e.g. reduction of fertilizer application and restriction or elimination of nutrient leaching from greenhouses to the environment) – therefore, in many countries, the application of closed hydroponic systems in greenhouses is compulso by legislation, particularly in environmentally protected areas, or those with limited water resources.

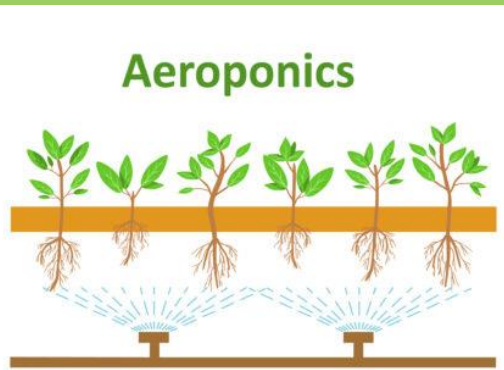
Water culture or hydroponic systems



- Deep water culture (DWC)
- Float hydroponics
- Nutrient film technique (NFT)
- Deep flow technique (DFT)
- Aeroponics







Substrate culture

- Gravel culture
- Sand culture
- Bag culture
- Container culture
- Trough culture

Viticulture and Viniculture

- Viticulture - a natural science tasked to study the biology, assortment and technology of grapevine growing.
- Enology is the science that studies wine from every aspect from the harvest of the vine through production to the keeping of the wine.

GRAPE AND WINE

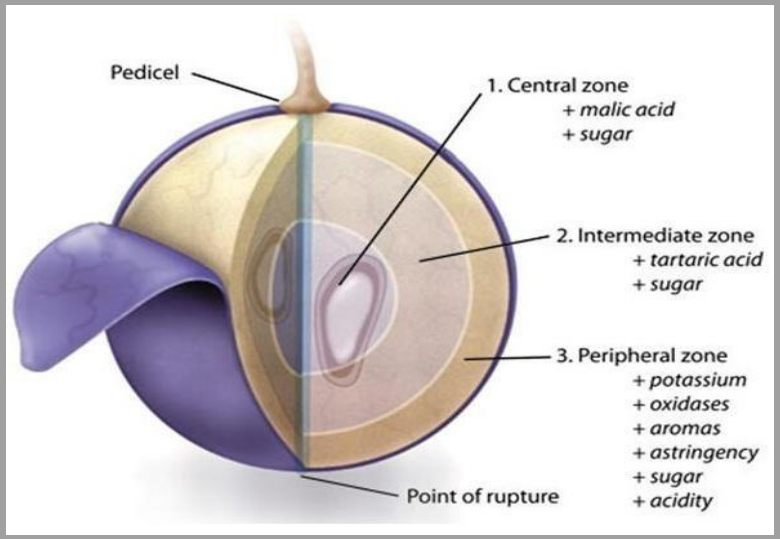
- The grapevine has long been attracting the attention of man with its delicious fruit (grapes) that could be used directly as food (for **eatting** – table grapes) or processed into other foodstuffs (**wine**, grape juice, compotes ...).
- A kilogram of grapes gives the body about 800 easily digestible calories, and can satisfy a quarter of the daily caloric requirements of an adult.
- Grapes (especially dark blue-red and red) belong to the „**super foods**".
- Grapes should be eaten in the morning because it works better. Seeds should also be eaten as they contain proteins and other nutrients.

Chemical composition of fresh grapes:

Water	**75-80%**
Sugars	**15-25% (most glucose and fructose)**
Organic acids (Organske kiseline(	**0,05-0,75% The most tartaric and malic, and couple of citric and lactic acid (najviše vinske i jabučne, a manje limunske i mliječne)**
Total Phenols	**0,25-0,75%**
Vitamins (in 100g of fresh grapes)	**Vit. B_1 0,04mg. Vit.B_2 0,04mg i Vit. C 4mg.**
Minerals	**K 160-250mg; P 26mg; Ca 22mg; Fe 0,5mg, Na 1-5mg.**

Grapes have energetic, dietetic, prophylactic and medicinal values.

- Natural sugars in grapes constitute a significant source of energy substances that stimulate the work of brain cells and heart muscle.
- Acids and their salts successfully regulate the basic blood reaction, thereby affecting the working capacity and vitality of the human body.



- **The mineral substances contained in the grapes participate in the building of bones, blood and and the nervous system.**
- **Polyphenols, and above all anthocyanins and tannins from grapes, have a pugative effect, facilitate circulation, etc.**

- **WINE** the agri-food product produced by the alcoholic fermentation of grape must.
- Wine is an alcoholic beverage, but it contains more than 800 chemical compounds, so some call it "**liquid food**".
- It has a significant effect on the specific functions of the organs and the metabolism of the human body in general. They call the wine "**milk of old**" because it improves digestion. A liter of wine contains 700 calories.

Chemical composition of wine:

Water	75-80%
Alcohol	7,5-15% (ethanol, higher alcohols, aliphatic alcohols...)
Acids	4,5-15g/l (tartaric, malic, citric...)
Minerals	1,5-3,5g/l (K, Ca, Na, Mg, Fe, Cu, Co, Zn, J, Se
Vitamins	Vit. C, B_1,B_2, PP factor, vit.P, pantothenic acid, B_6, B_{12},biotin
Amino acids (Aminokiseline(	oko 0,0035g/l
Aldehydes, tannins, esters, nitrogen compounds, aromatic compounds	in minimal quantities
Salicylic acid	about 60 mg/l.

Wine has a complex chemical-biological and enzymatic composition.

The medicinal properties of wine

- For wine has long been said to represent the most hygienic drink. It is antitoxic and in association with acids of the stomach prevents diseases of the intestines, bile and urinary canal and kidneys.
- Red wine plays an important role in preventing the occurrence of arteriosclerosis, a myocardial infarction, and has an inflammatory and antiviral effect.

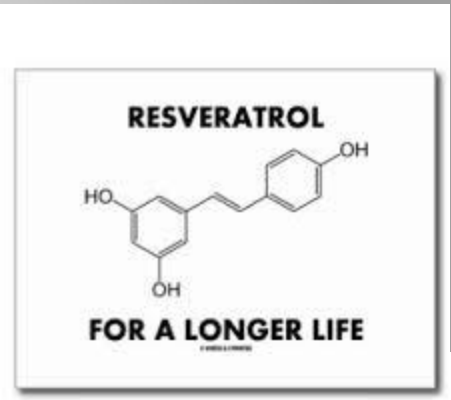
The medicinal properties of wine

- Vitamin P facilitates blood circulation, protects against blood flow, has a positive effect on vision and has a bactericidal effect. The bactericidal action of the wine is three times stronger than the aqueous alcoholic solution.
- Wine prevents influenza, bronchitis and relieves asthmatics. Helps with colds, regulates pressure, is a powerful diuretic, good for digestion and strengthening the body, for healing wounds.
- Doctors recommend that patients drink a glass of red wine every day after a complicated illness of complicated surgical interventions.

The medicinal properties of wine

- Wine has a beneficial effect on the adoption of vitamin B12, on the increased acidity in the stomach to old people and on the function of many glands.
- In chronic stress, there is an increased need for vitamins C and B, calcium and magnesium, and moderate wine consumption can have a positive effect on stress relief.
- In non-flavonides, wines contain important groups of hydroxycyclic acids and resveratrol. Hydroxycyclic acids are found in red wines up to 500 mg * / liter. This group has very high antioxidant properties

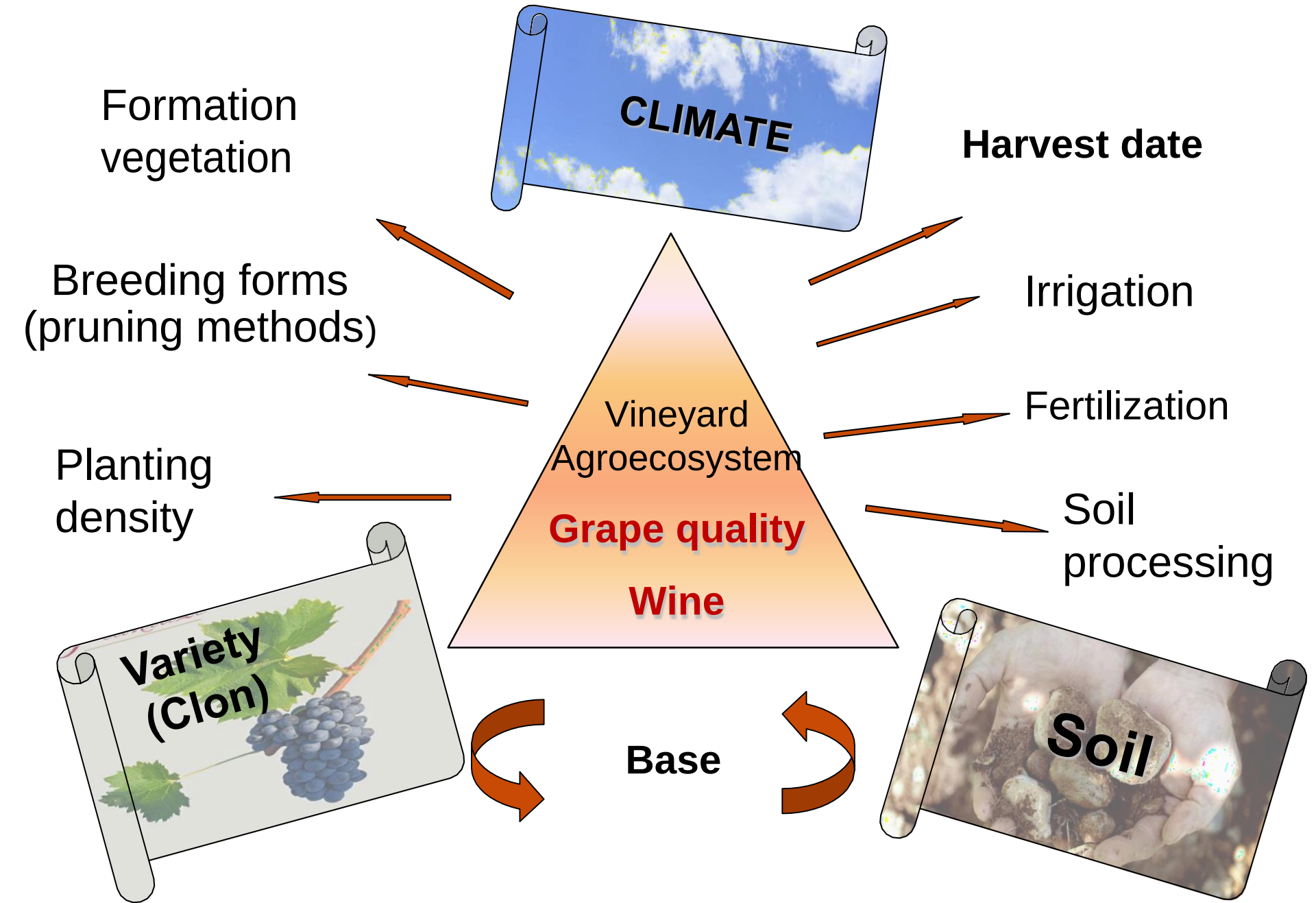
- Resveratrol is the most researched ingredient in red wine, discovered in 1992. It has seven times more antioxidant activity than Vitamin E.
- Resveratrol has antioxidant, anticancer and cardioprotective effects. Studies have shown a significant neuroprotective effect of resveratrol, as well as that it slows down the natural decay and death of cells.
- It improves pulmonary function, slows down the growth of some types of tumors such as skin melanomas. Resveratrol and its protocin extract have cardioprotective effects, but research has also shown a beneficial effect in the case of cardiac arrhythmias.



Resveratrol content in some red wines

- French paradox is the name for scientific studies that have shown that the beneficial effect of wine is the reason why the French, despite the unhealthy diet, have the lowest percentage of heart disease.In France and Italy, where the highest consumption of wine per adult, the death rate from myocardial infarction is three to five times smaller compared to Scotland and Ireland.

Factorts that make vineyard agroecosystem



FACTORS THAT DETERMINE QUALITY OF WINE

I Grapevine variety (must belong to the type of Vitis vinifera):

1. Varieties for quality and top quality wines
2. wine table varieties

II Soil

*Physical, chemical and biological properties of soil -

affect the yield, degree of maturity of the grapes, the content of the extract and acid

III Climate

* temperature, sunshine, precipitation, wind, relative humidity, special significance of microclimate
*moderate climate zone (Mediterranean, JA, California);
*coastal-atlas climate (Central, Western and Eastern Europe);
*humid-tropical zone (possible production of quality grapes).

TERROIR

- 290 sunny, and very few rainy days
  Fluvial-glacial sediment
- Autochthonous varieties
  Vranac and Krstač
- Traditional methods integrated into the latest technolog

Value of variety

The grape variety is known to bind itself to territory, history and tradition.

All this contributes to emphasizing her autochthony and the importance of terroir in displaying her best qualities.

In this way, the national product becomes a powerful marketing tool because it represents the value of origin, tradition, history, hard work, care and knowledge.

VARIETY

Variety in viticulture plays a special role

- The consumer does not ask what kind of sunflower oil is derived from, wh breed of pig is meat or processed products ...
- The consumer often wonders of which variety is the wine he drinks or the grapes he eats
- Some varieties of grapevines have been cultivated for centuries, known al over the world
- New varieties, especially wine varieties, hardly find a place in production (tradition, habits, economic effects ...)
- Table varieties are more easily and quickly been accepted
- The selection of sorting was made on the basis of analyzes of a large number of indicators

VARIETY = **SORTA** (in Montenegrin); **CEPAGE** (in French);
REBSORTE (in German); **COPT** (in Russian)
VITIGNO (in Italian); **VARIEDAD** (in Spanish);
CULTIVAR (OIV)

Basics of assortment classification

- According to the mode of exploitation of grape varieties are classified (Negrulj):

1. Wine varieties

- For table vine
- For quality wines
- For premium wines
- For sweet dessert wines
- For semi sparkling and sparkling - champagne wines

2. Table varieties + grapes intended for fresh consumption

- for local use
- Tansportable varieties-more distant markets
- For storage during winter

3. The varieties of grapes for drying

- Seedless;
- varieties for making sweet, compote, marinade…

According to the sum of heat degrees from the day when the average daily temperature is 0°C until the maturation of the grapes (Gasparen), the varieties are grouped by maturation periods (epochs) as follows:

- 1st maturation epoch - the required temperature sum for grape maturation2.254°C
- 2nd maturation epoch - the required temperature sum for grape maturation3.400°C
- 3rd maturation epoch - the necessary temperature sum for the maturation of grapes 3.564°C
- 4th maturation epoch - the necessary temperature sum for the maturation of grapes 4.133°C
- 5th maturation epoch - the necessary temperature sum for the maturation of grapes 4.238°C
- 6th maturation epoch - the necessary temperature sum for the maturation of grapes 4.392°C
- 7th maturation epoch - the necessary temperature sum for the maturation of grapes 5.000°C

Ampelography is a science that studies the species and varieties of grapevines.

A large number of native and autochtonous vine varieties in Montenegro have not been fully identified. For some, there is some identification (ampelographic description) using OIV codes, but this is often not sufficient for their complete and secure identification.

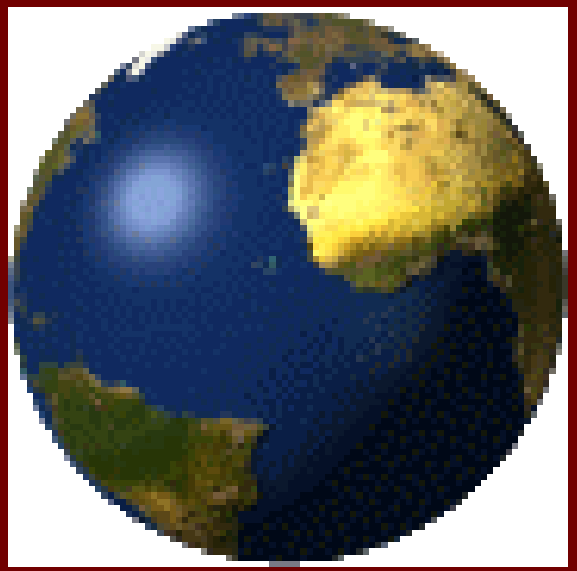
Therefore, in addition to ampelographic - ampelometric methods, molecular - genetic methods are used as the most reliable means of determining the structure of DNA. Genetic identification of grapevine is done in order to securely identify the variety in order to reliably determine the synonyms and homonyms of the variety, their origin and origin - pedigree (identification of their kinship, parents of the varieties and their association).

In order to be considered an **autochthonous variety** of grapevines, it must be confirmed that the variety originated in a particular area and that its parents who were domesticated in the area are discovered. The second, more common assumption about the autochthony of a variety is the long tradition of cultivation of that variety in an area to be proven (number of offspring, heterogeneity of the population, a large degree of viral infection within the population, historical and literature sources - data).

Introduced varieties - varieties that, after being tested in our agro-ecological conditions, are introduced-imported into our countries and achieve good - excellent quality of grapes and wine.

Wine regions

- France
- Italy
- Spain
- Portugal
- U.S.A.
- Chile, Argentina
- Australia, New Zealand



White grape varieties grown in Bordeaux-France

Sauvignon Blanc

Muscadelle

Colombard

Sémillon

Merlot Blanc

Ugni Blanc

Sauvignon Gris

Grape varieties grown in Provence-France

Monastrell

Grenache

Cinsault

Tibouren

Carignan

Syrah

Cabernet Sauvignon

Grape varieties grown in Italy

Sangiovese

Barbera

Nebbiolo

Montepulciano

Pinot Grigio

Grape varieties grown in Spain

Granacha

Tempranillo

Bobal

Monastrell

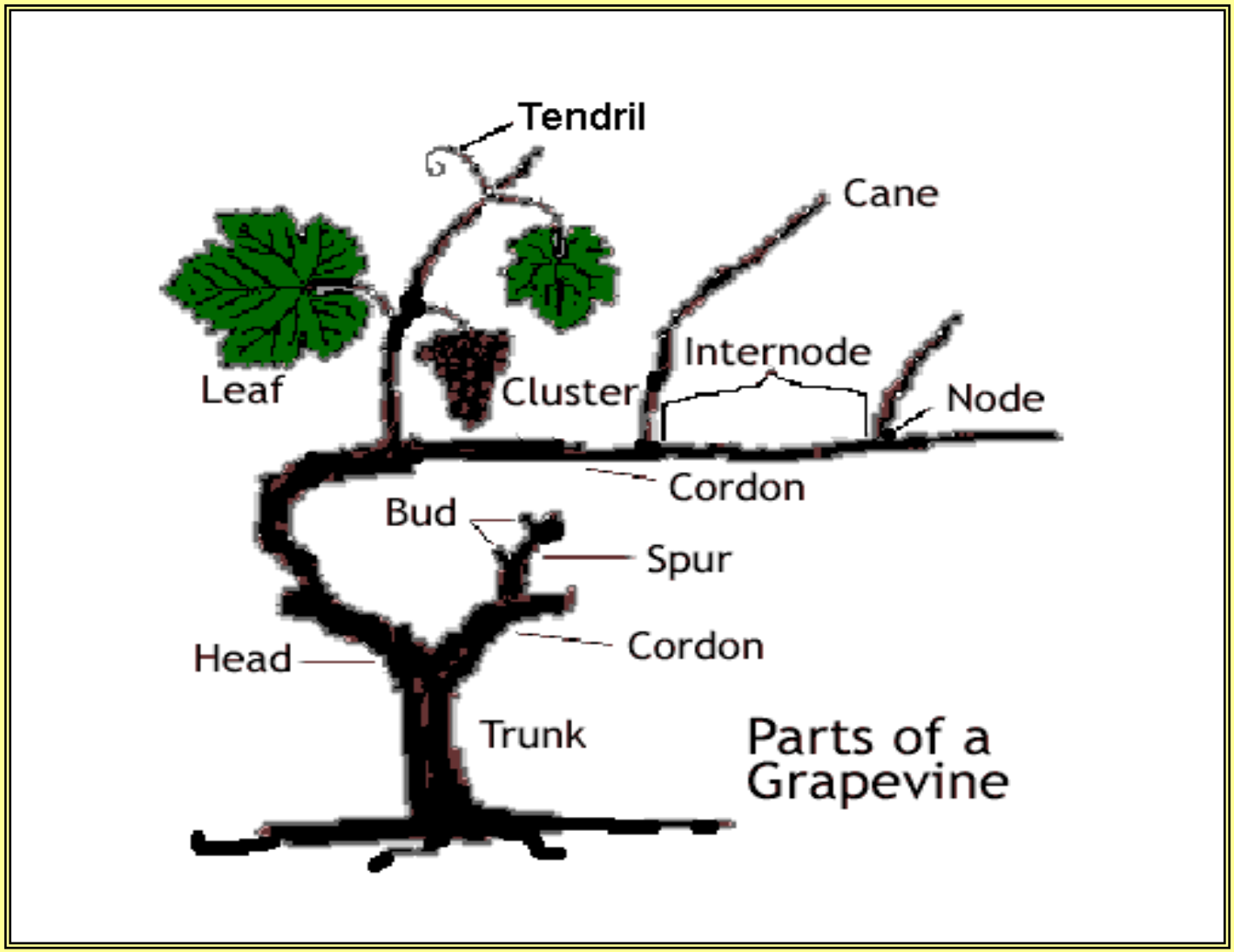
Airen

Viura/Macabeo

Palomino

Albarino

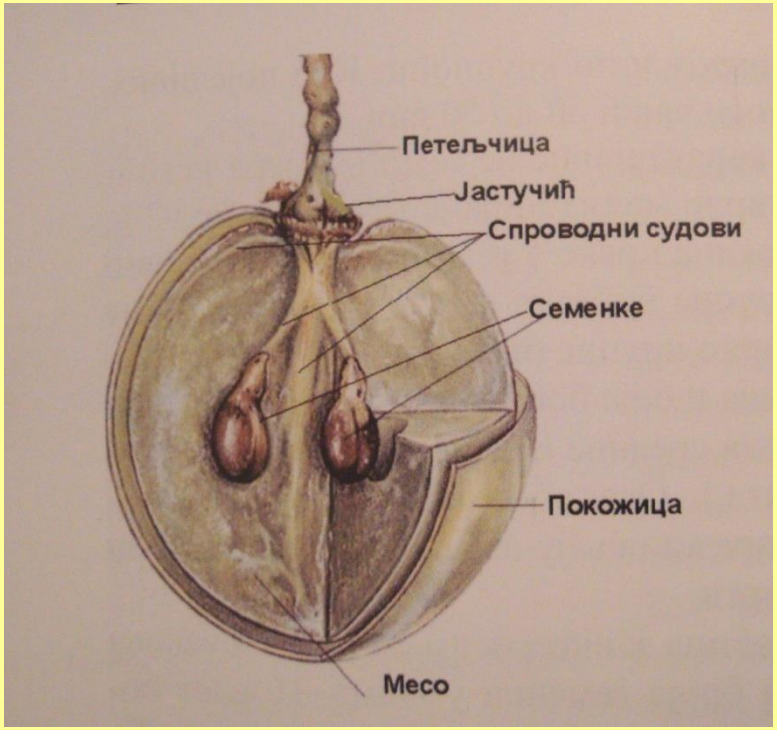
GRAPEVINE ORGANS



- The noble grapevine is called vine
- Vegetative and generative organs are distinguished at each vine
- Vegetative organs are: root, trunk, branches, cane and leaves
- Generative organs are: inflorescences, flowers, clusters, berries and seeds

Berries and seeds

The berry is a fruit of the grapevine that is used for eating and further processing



Composition of berries is skin, funnel bundles, meat and seeds

Phenological stage of development

Based on the external changes observed on the grapevine, the vegetation period is divided into the following phenological or developmental stages

1. **Juice Movement - Tearing**
2. **Activation of the buds (budding) and growth of the shoots**
3. **Flowering and insemination**
4. **The development of green berries**
5. **Grape maturation- veraison**
6. **The maturation of leaves and the falling of leaves**

Grape maturation- veraison

- This phenophase begins with the appearance of the verasion (by changing the color of the skin) and lasts until the grapes reach full maturity.
- During the verasion, significant morphological and physiological changes occur in the berries
- The berries reach their full size and shape at this stage
- The green color of the berries in white varieties gradually turns to yellowish with various shades and the skin becomes semi-transparent. For black varieties, the color changes from red to dark blue
- When matured, glucose exceeds fructose and organic acid content decreases. When physiological maturity is reached, the amounts of glucose and fructose are equalized, and the seeds are given a color and size typical of a given variety

HARVEST TIME AND USE OF GRAPES

Grape maturity is a physiological-biochemical process during which sugars, organic acids and other substances are synthesized, transformed, moved and accumulated.

*The process begins from the *verasion (šarak)*-moment when the berries begin to lose their green color and melts to full maturity, when the increase in the sugar content and the organic acid content are stopped for some time in the berries.

Physiological maturity- the moment when the seeds ripen in the berry, but this ripeness is no longer relevant to the way the grapes are used.

Technological maturity - this maturity is the moment of grape harvesting and is primarily determined by the production purpose - for which the grapes are to be used: for fresh consumption or for drying, for the production of fine or table wines, etc.

Harvesting time is determined by the degree of maturity and the production purpose of the grapes.

The grape maturity is determined on the basis of the chemical composition of the grape juice: the content of sugars and organic acids and their relationship.

In determining the grapes maturity, the aim is to determine the average state of ripeness, taking into account the realistic sampling for analysis.

The methods used to determine the maturity of the grapes are: **organoleptic, physical and chemical**.

Organoleptic methods are widely used

Occurrences to be monitored:
Leaf gradually changes color - with white varieties fading first and then fading, with black becoming more or less red

The petiole or the entire ridge of the cluster begins to show changes - from green to brown, from a fresh state to a dry state

The berries receive a color characteristic of the variety-greenish-yellow, yellow, red and blue

The berries lose their firmness, become soft and easily detach from the petioles

The taste and aroma become harmonious and characteristic of each variety

Physical methods: Based on the determination of the density of grape juice

The density of the grape juice is mainly determined by the sugar content. It is determined on the basis of the physical phenomenon - the strength of light refraction and the specific gravity of the grape juice.

In practice, the most commonly used instruments are: refractometers and Brix refractometer (Ekslov širomjer).

Chemical method for determining maturity- determination of the content of sugar and acids in grape juice - must.

The procedure is complex, it is done in laboratory conditions.

GRAPE HARVEST FOR THE WINE PRODUCTION

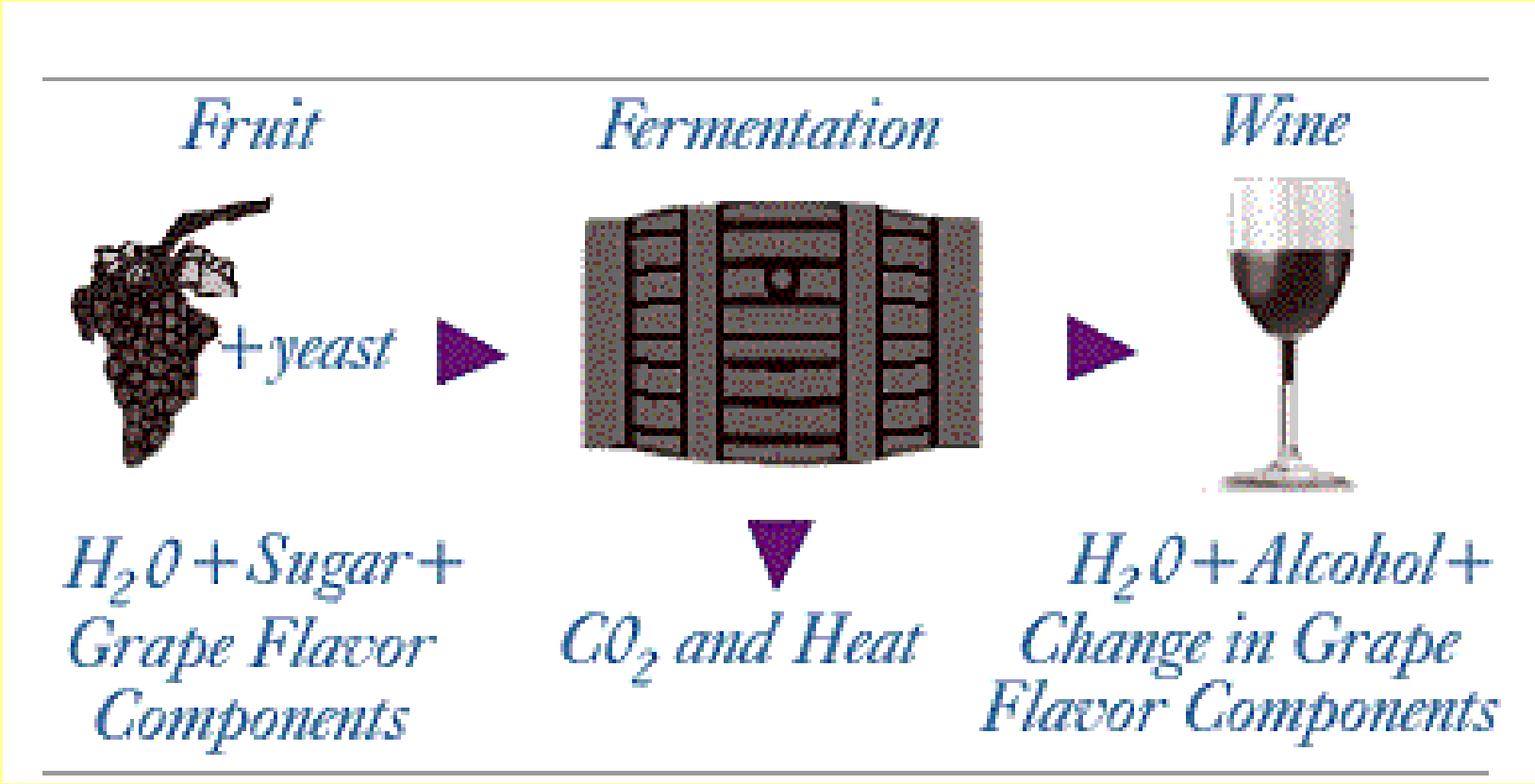
The largest mass of grapes is processed into wine. Particularly important for good wine quality is the proportion of sugars and the ratio of sugars and acids in grapes. This quality of grapes is obtained if the harvest is done at **full maturity.**

For the production of special wines, the grapes are left to overripe, to leave in the state of **dry twig (suvarak)**. To obtain natural dessert (sweet) wines, the grapes should be left on the vine to overripe.

In some well-known wine-growing regions (Tokaj), thick-skinned wine varieties are harvested very late, with the aim of developing a noble rot (Botrytis cinerea) on the berries, whose growth causes rapid loss of water and acid from the berries. Such grapes produce very high quality wine.

The harvesting of grapes intended for processing is usually done at once, but sometimes it works and screening vintage.

The harvest can be manual or mechanical.



How is wine made?

All About White Wine

White wine

Most but not all contemporary white wines focus on freshness and purity rather than embracing aromatic integration through refined structure, soulfulness and graceful

- white wine can be made with red or white grapes

The most popular white grape varieties are:

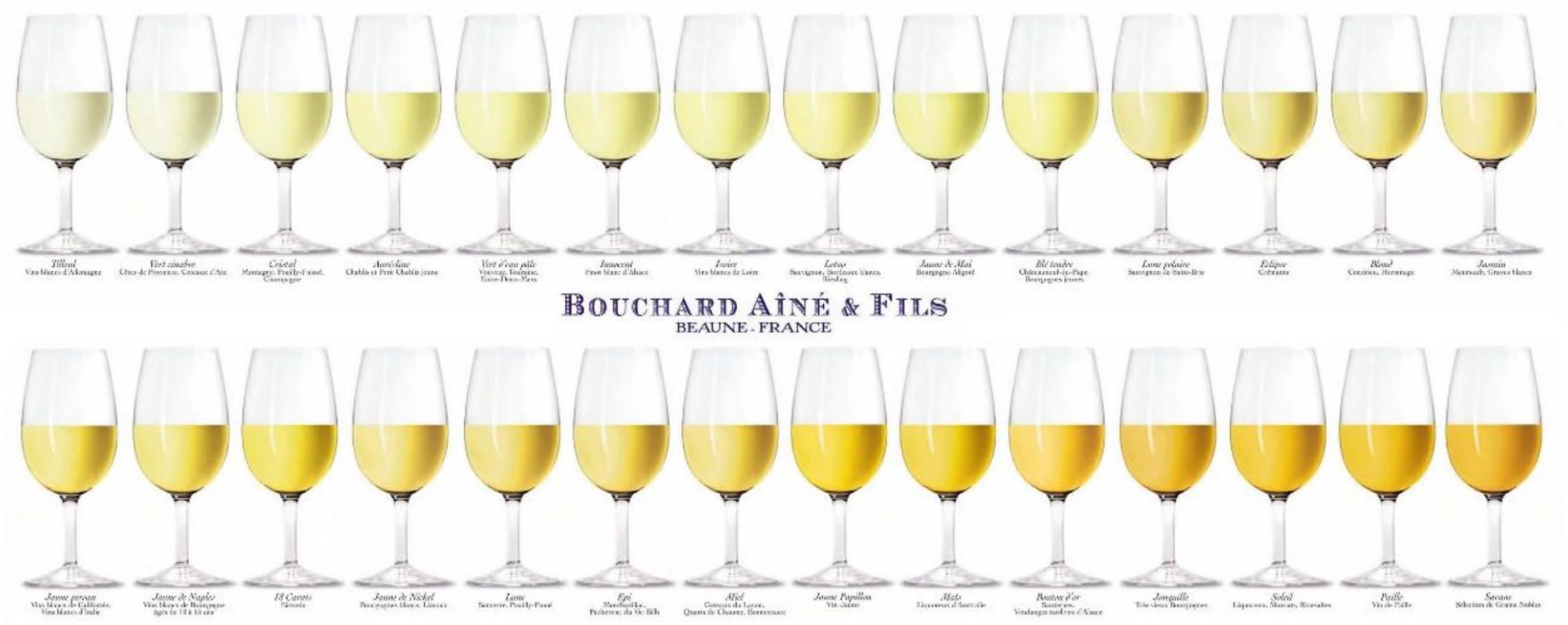
- Chardonnay
- Riesling
- Sauvignon Blanc

White grape varieties

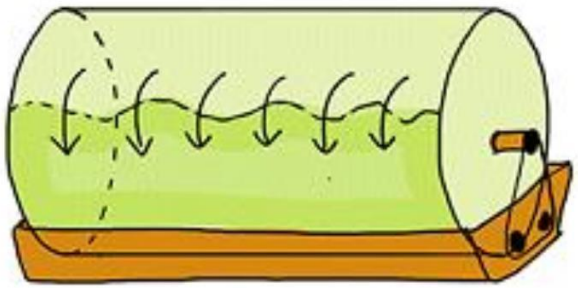
International

- Chardonnay
- Chenin Blanc
- Gewurtztraminer
- Muscat
- Pinot Grigio
- Riesling
- Sauvignon Blanc
- Pinot Blanc

White wine colour



How is White Wine Made?



PRESS

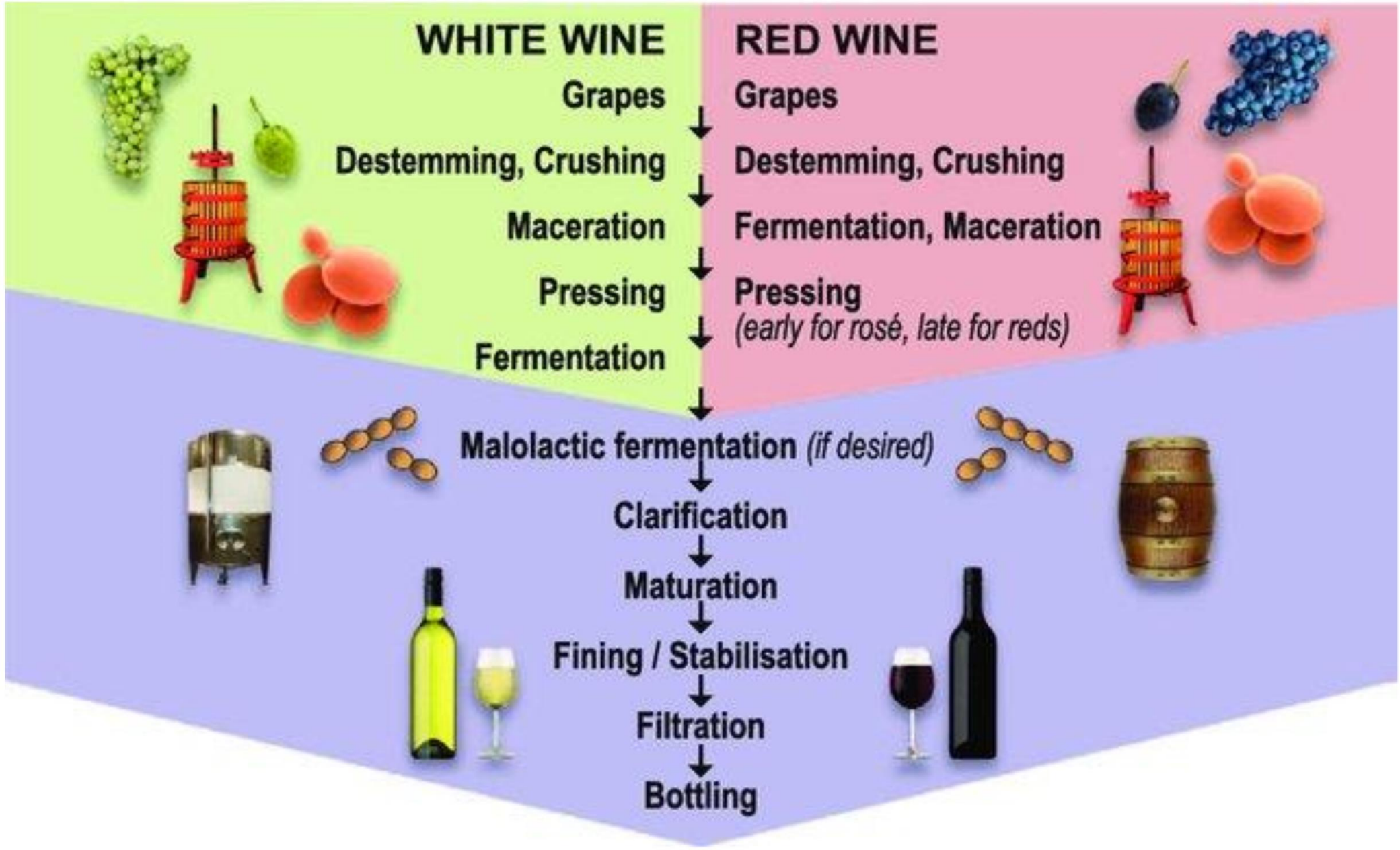
EXTRACT JUICE FROM THE GRAPES

FRENCH : "PRESSURAGE"

SETTLING

PARTICLES FORM SEDIMENT AT THE BOTTOM OF THE TANK

FRENCH : "DÉBOURBAGE"


WHITE WINE
Grapes
Destemming, Crushing
Maceration
Pressing
Fermentation
RED WINE
Grapes
Destemming, Crushing
Fermentation, Maceration
Pressing
(early for rosé, late for reds)
Malolactic fermentation (if desired)
Clarification
Maturation
Fining / Stabilisation
Filtration
Bottling

Harvest

- Cooler temperature
- it helps to concentrate the aromas and flavours
- better control over the fermentation process
- keeps sugar levels more stable
- less oxidation of fruit
- Grape quality – potential for better wine

Night harvesting is part of the reductive winemaking style favored by modern vintners.

Pressing

- either crush or de-stem grape first or just add them straight into the press.
- **<u>Crushing before pressing:</u>**
  Since you will be pressing the fruit anyway, the berries don't need to be completely mashed – just removed from the stems. The combination of juice, skins, seeds, and pulp that falls into your holding vat is now called **"must"**.
- **Pros:**
- Allows winemaker to work with skins if desired (so any style of wine can be made).
- No fear of extracting harsh stem tannins during pressing.

Grape crasher - destemmer

Pressing

- Unlike in the red wine process, ***pressing occurs before fermentation***.
- the entire harvest (or crushed grapes) is placed in a press (pneumatic or plate) and the berries are crushed, releasing the juice (still cloudy).
- It is collected in the trough (receptacle beneath the press) and pumped into a tank.

Gentle pressing, avoiding the crushing of pips, results in better quality juice. The skins of white grapes are not used during the fermentation process.

Settling (Clarification)

- Once we finish pressing we will have a light green/yellow colored juice that will be very cloudy.
- This cloudiness is coming from fine grape particles/solids that have been created during the crushing-destemming and pressing stages. Removing these solids is highly recommended because doing so dramatically lowers the production of ***heavy, harsh, green/herbaceous, and sharp notes*** from potentially developing in our white wines during the fermentation.

Clarification

- The juice is drained from the press into settling tanks. If the must is not cleared of solid matters, then off tastes can result. A simple settling over a period of 12 to 24 hours

When the solids are removed we get cleaner, more aromatic and fruity wines.

Quite simply:

a clean juice makes a clean wine.

Grape crasher

Cloudy Grape must

Clarified grape must

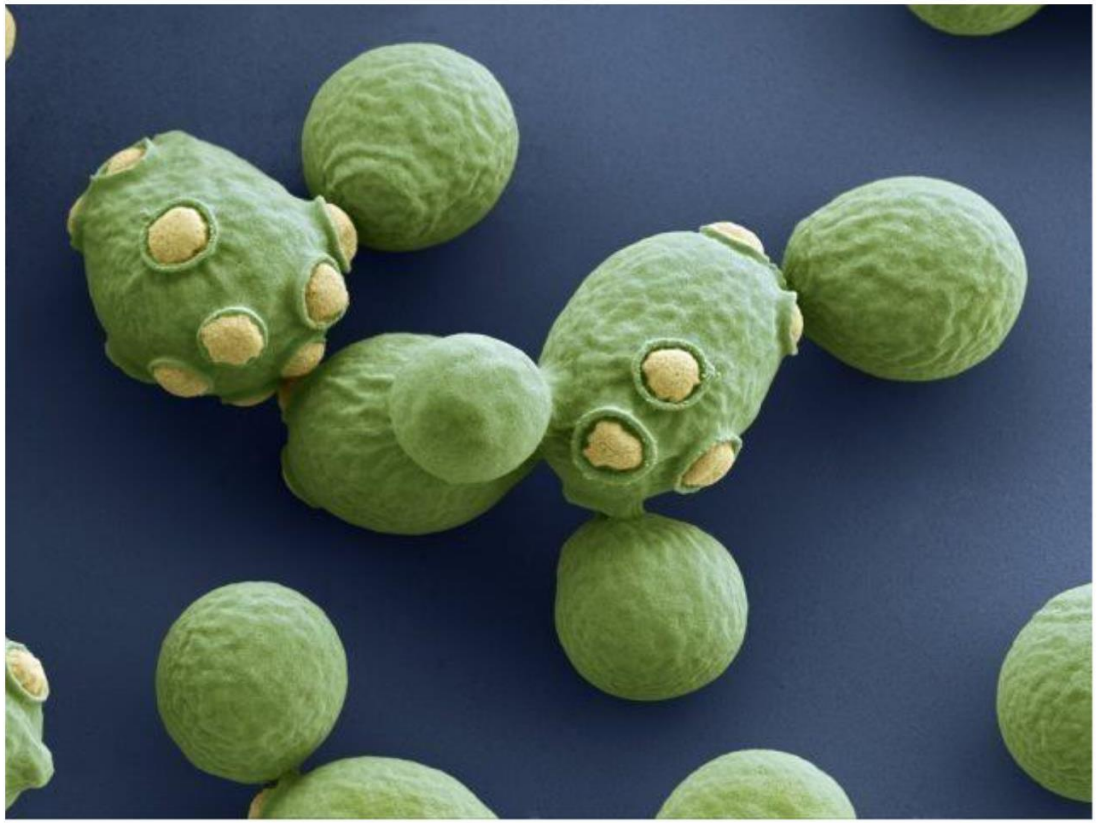
Alcoholic fermentation

Alcoholic fermentation

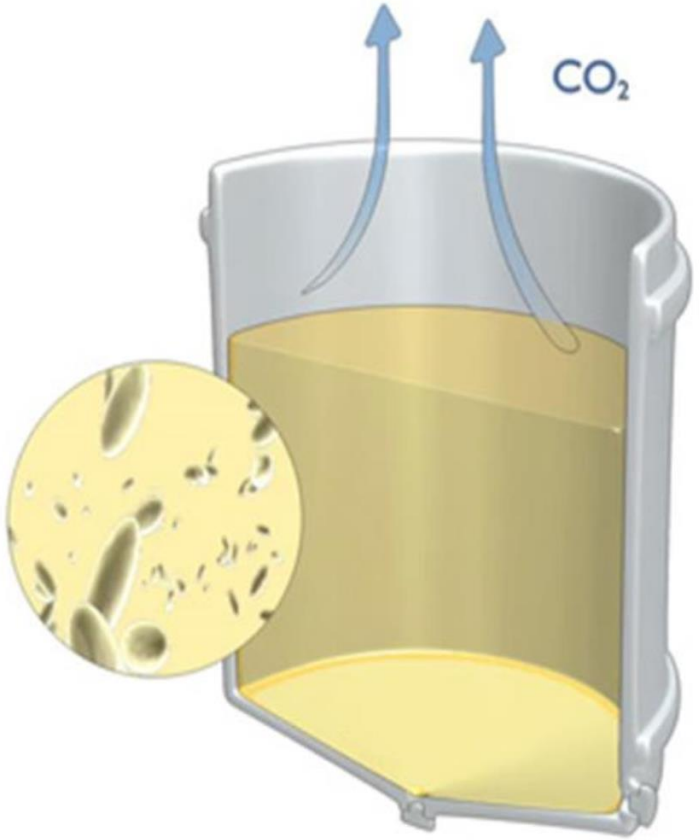
- The major difference between white and red wine is that white wines are fermented without the grape skins.
- White wines are typically fermented ***much cooler than red wines.***
- at around **10° to 18 °C** and over a longer period to ***preserve primary fruit flavours***.
- Each vat is under temperature control, usually with its own chilling system.

Ideal Wine Fermentation Temperature		
Type	**Red Wine**	**White Wine**
Temperature（℃）	**20~32**	**12~22**
Temperature（℉）	**68~89.6**	**53.6~71.6**

Alcoholic fermentation

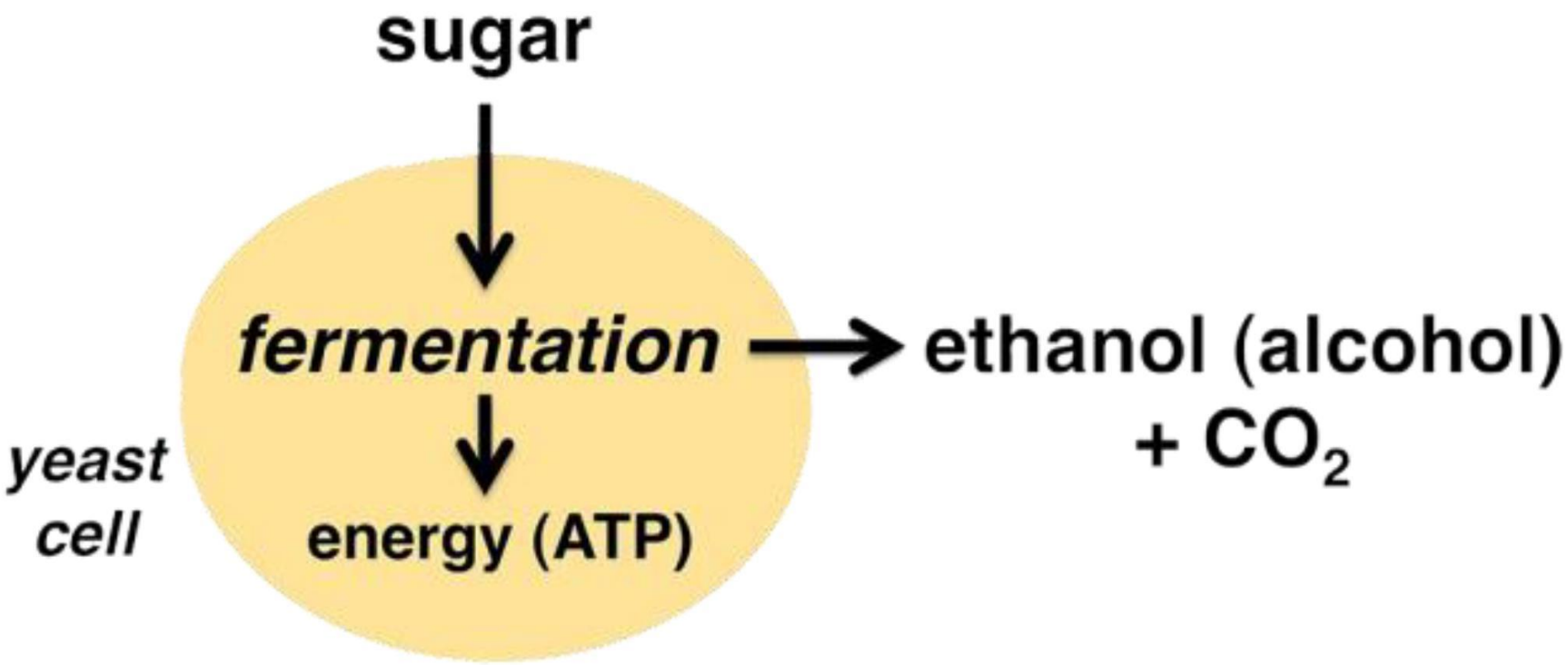


Saccharomyces cerevisiae

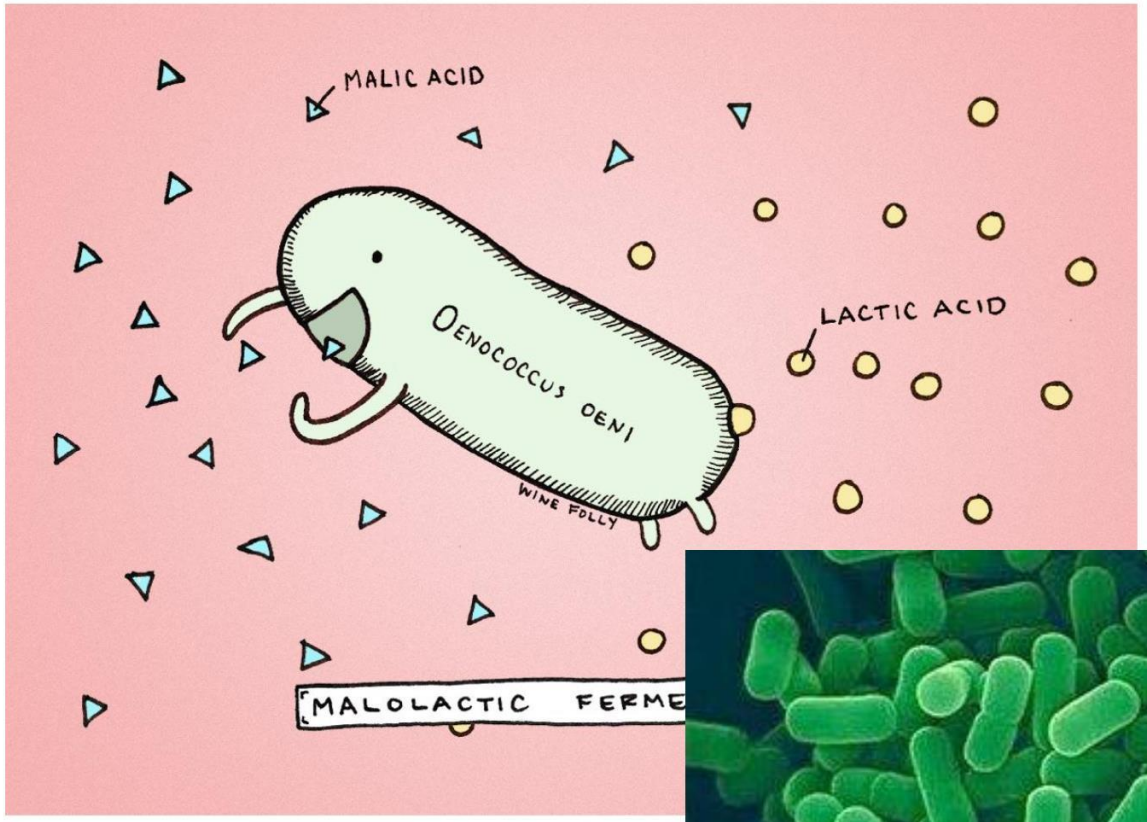


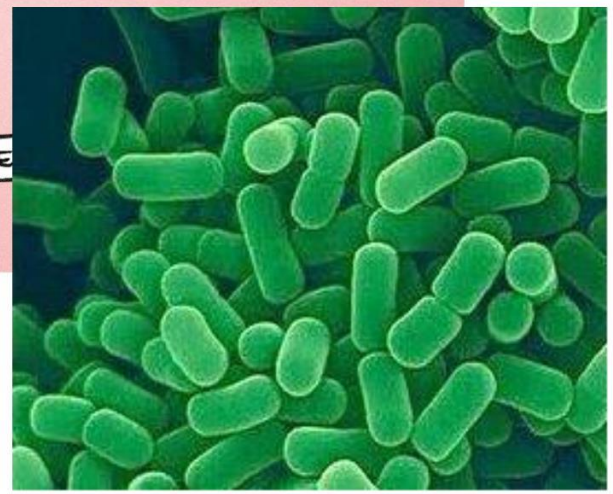
Alcoholic fermentation

- The higher the sugar content of the juice the higher the resulting alcohol level.



Malolactic fermentation





- ***Oenoccocus oeni* -** bacteria strains
- some white wines go through a process called ‘malolactic fermentation’
- conversion of any remaining ‘tart’ malic acid (think *green apples*) in the wine to the softer lactic acid (think milk).

Malolactic fermentation

- The process reduces acidity in wine and also releases some carbon dioxide in the meantime.
- One way to recognize MLF in a wine is to note ***if it has a creamy, oily mid-palate texture***.
- Another easy way to identify the ***malo*** is to see if the wine was aged in oak, since MLF typically occurs while wines age in oak barrels.
- It’s not uncommon for white wines to let only a small percentage of the wine have the malolactic conversion.
- adding texture and body to the wine without losing too much of the positive floral and citrus aromas that waft off when white wines are aged in oak.

Malolactic fermentation

- ***No MLF:*** Wines made without any MLF will focus on the fruit, such as ~~Germani~~c whites (Riesling & Gewürztraminer) and New World Sauvignon Blancs.
- ***With MLF:*** Wines that are made with a complete MLF may not have the ~~singular fo~~cus of fruit intensity in them, but they make-up for it by their complexity. The MLF adds desirable flavors and aromas while also contributing positively to the mouthfeel of the wine- indeed the white wines of Burgundy, Bordeaux, and the Loire owe a lot of their complexity to malolactic fermentation!
- ***Partial MLF:*** In recent years, there has been a move to try and get the best ~~of both worl~~ds (intensity of fruit and complexity) by doing partial MLFs. The MLF is initiated then stopped by the winemaker when he/she feels they have gotten enough complexity in their wine without covering-up the original fruit qualities.

White wine - aging

- **FIRST STEP:**
- **Racking / Sulphiting** : when malolactic fermentation is completed (total absence of malic acid) the wine is racked once more, i.e. it is moved to another container.
- The wine is transferred from a tank to a tank/barrel or from one barrel to another (if malolactic fermentation has taken place in barrels).
- The wine remains fragile and at the time of this racking it is sulphited: sulphite is added to the wine.
- *Separate the "clear" wine and eliminate the lees (sediment at the bottom of the tank or barrels)*
- *Sulphiting helps avoid the quality of the wine being degraded due to the development of detrimental microorganisms and protects it against oxidation*

White wine aging

End of alcoholic fermentation, as soon as the sugar are consumed, in the fermenting tank:

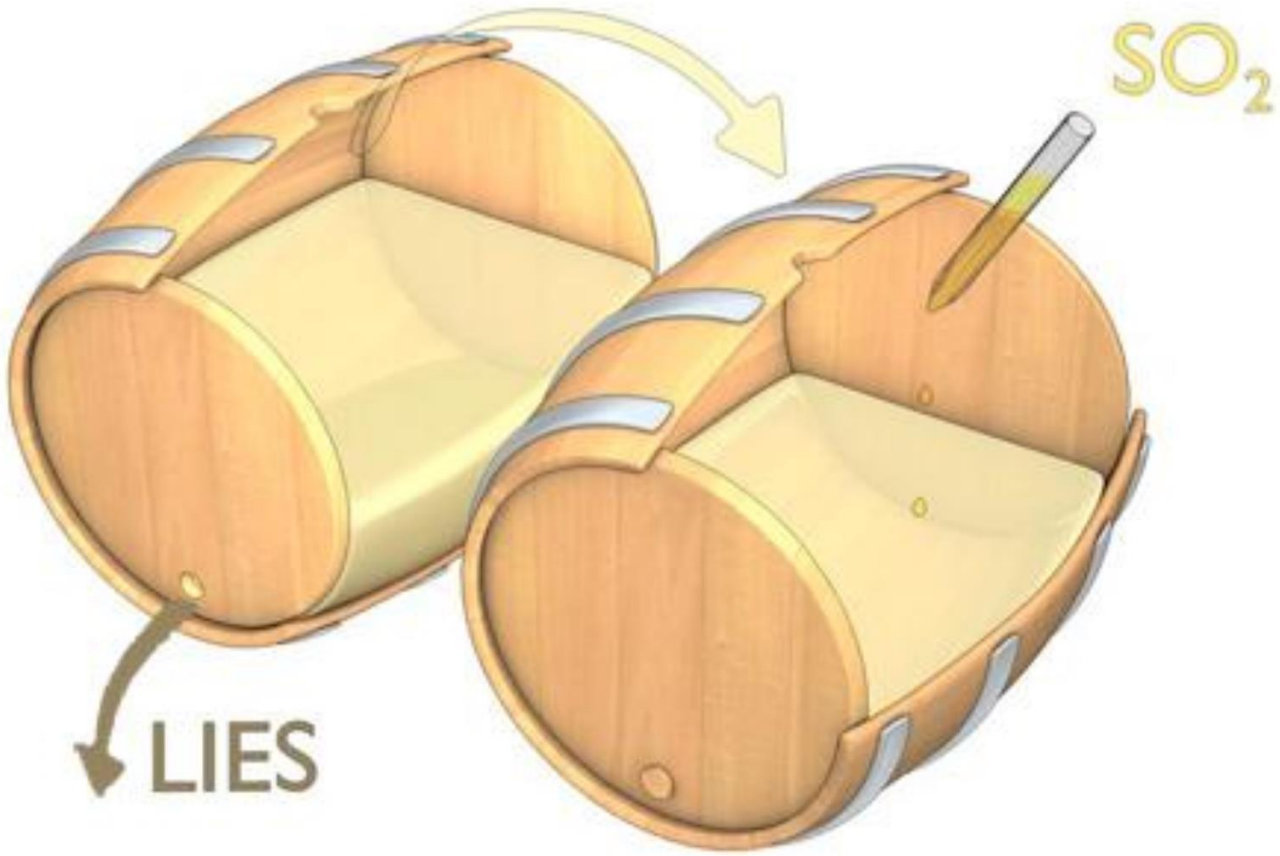
- Check that pH is around 3.2
- Addition of metabislfite, ascorbic acid..homogenization, elimination of oak chips during the racking.

First step of aging

- Adjust temperature to 12°C
- Wine agitation
- Lees aging to build the colloidal matrix
- Keep pH below 3.25
- Temperature : <12°C.

White wine - maturation

White wines are also much more susceptible to discoloration (e.g. turn yellow-brown) and don't commonly cellar as long as red wines.



White wine - oxidation

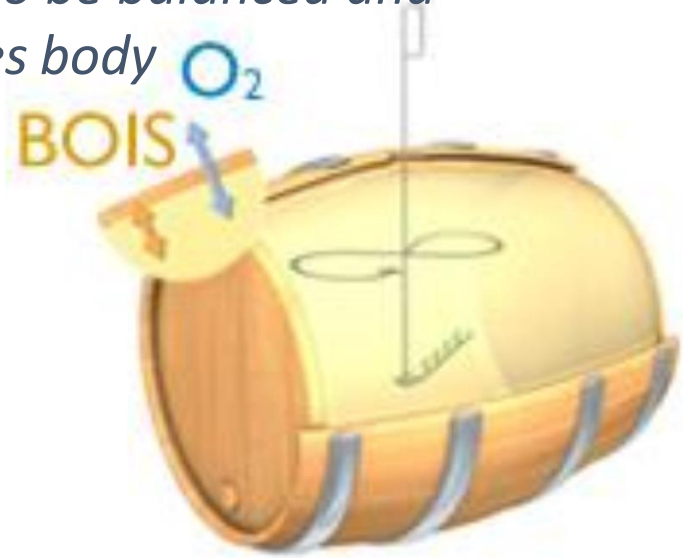
If the juice is slightly brown in color, with zero aromas of fruit and a lackluster palate, potentially displaying notes of vinegar, then yep, sounds like you got yourself a fully oxidized wine. Unfortunately, oxidation cannot be reversed and the wine will be ruined.

White wine - maturation

Maturation in oak barrel

- the wine is stored in barrels (225 L – 5000 L) for a duration of 6 to 18 months on average.
- Gas exchanges occur through the wood and the wood yields compounds into the wine.
- When the wine is matured on lees it is stirred using a specific stirring stick to keep the fine lees in suspension.

The wine evolves from an aromatic and structural point of view thanks to the numerous reactions that occur due to the oxygen that passes through the wood and the elements that are released into the wine by the wood, such as aromatic compounds. Stirring allows the wine to be balanced and maturing on lees provides body



White wine - maturation

- Much white wine is stored in stainless steel or concrete vats until ready for bottling. It is important that oxygen is excluded, and the vats should be kept either completely full or blanketed with nitrogen or carbon dioxide. Even if white wine has been fermented in barrel, it may be that it continues its maturation in barrel, too, to obtain more oak flavours.

Final technological operations

- Blending
- Filtrations
- Bottling

Racking / Blending

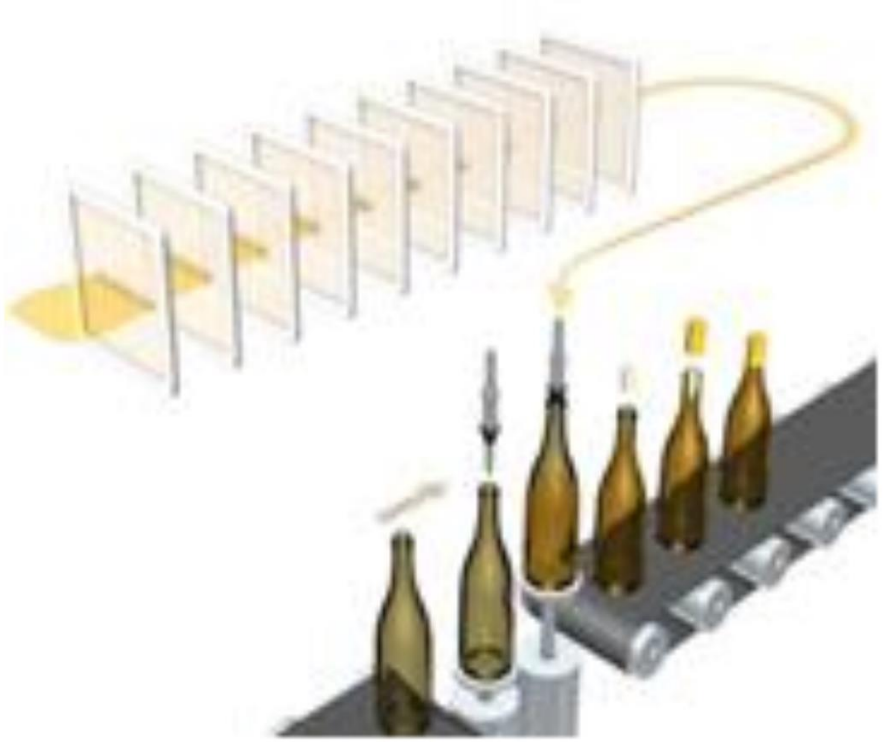
- the wine is racked to be put back into the tank at the end of maturing in order to be bottled. This allows the level of sulphur to be readjusted in order to store in bottles.
- Blending is a critical in achieving the final desired style. Wines made from a mix of different grape varieties are probably what we think of first when we think of blends. But varietal wines are very often blends also – blends from different vineyards, blends of wines from different vats that were treated differently during winemaking or maturation. Blending enables the winemaker to achieve ***smoothness and consistency in a wine***.

Fining

- the addition of a protein (such as egg white), mineral (bentonite) or synthetic (pvpp) substance called fining agents, brings about the formation of particle clusters in suspension in the wine that cloud it or that can cloud it.
- It settles at the bottom of the tank by sedimentation and allows the wine to be clarified.

Filtration / bottling

- in order to be bottled the wine must be free of all elements in suspension and be clear and shiny. It can be filtered according to different techniques.
- The wine is then pumped into a tank and the bottles are filled using a filler and corked using a corking machine. The bottles are then capped and labelled ready to be put on the market.
- White wines must be protected against excessive oxygen addition during bottling.



Filtration

Static or classical filtering

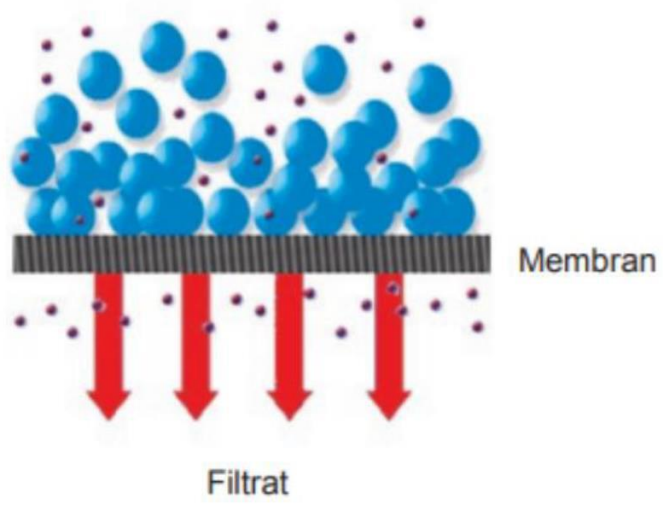
-periodically change the filtration layer or plate

-retention of particles by absorption (float, plate)

Earth filtration uses DE as the filter medium, and takes place in two stages:

Pre-coating: a layer of coarse grade earth is deposited on a supporting screen made of nylon or stainless steel.

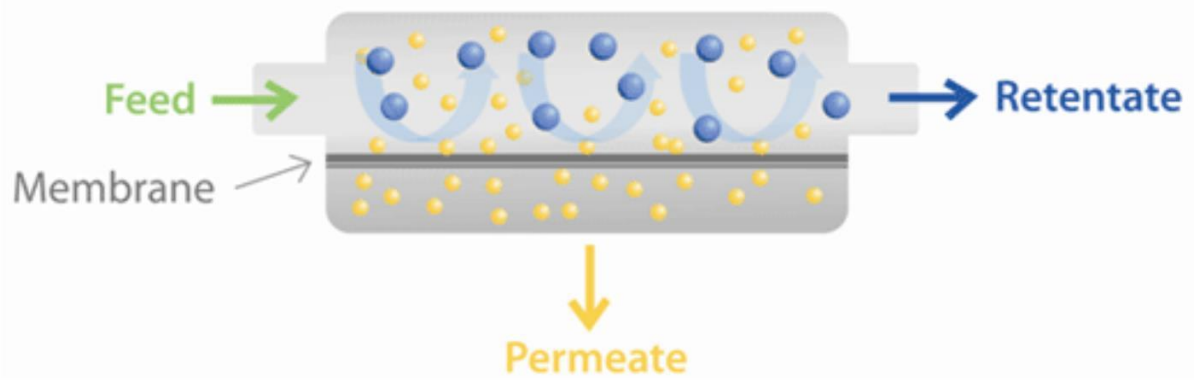
Filtration: earth is mixed into the wine and the mixture is passed through the screen. This leads to a continuously replenished filtration surface.

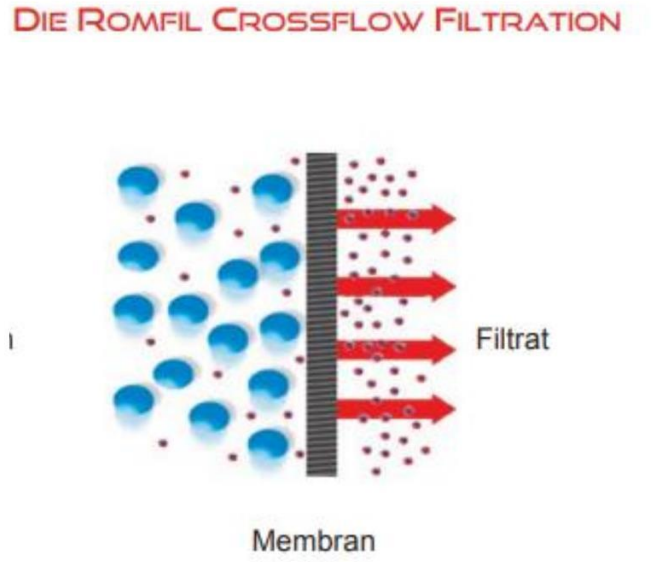


Cross-Flow Filtration

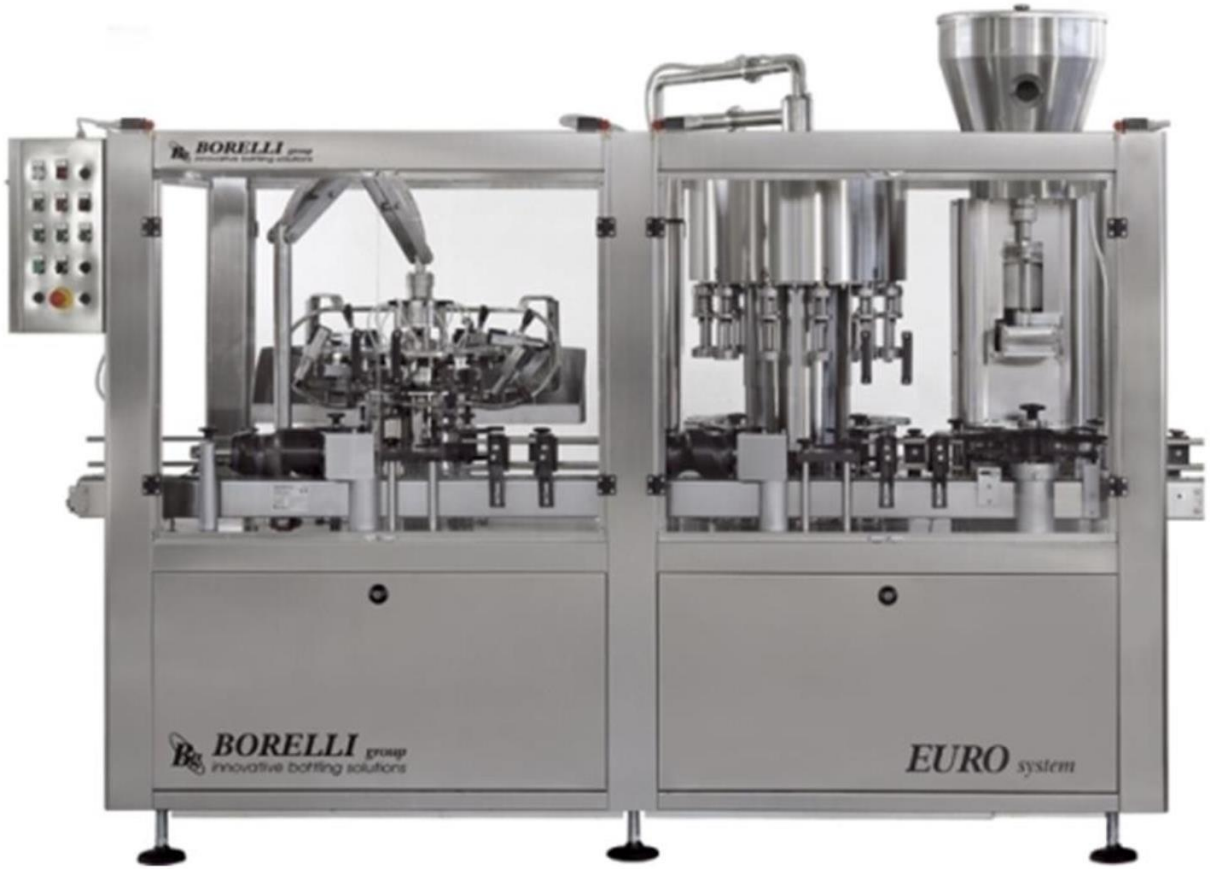
Active or tangential filtration

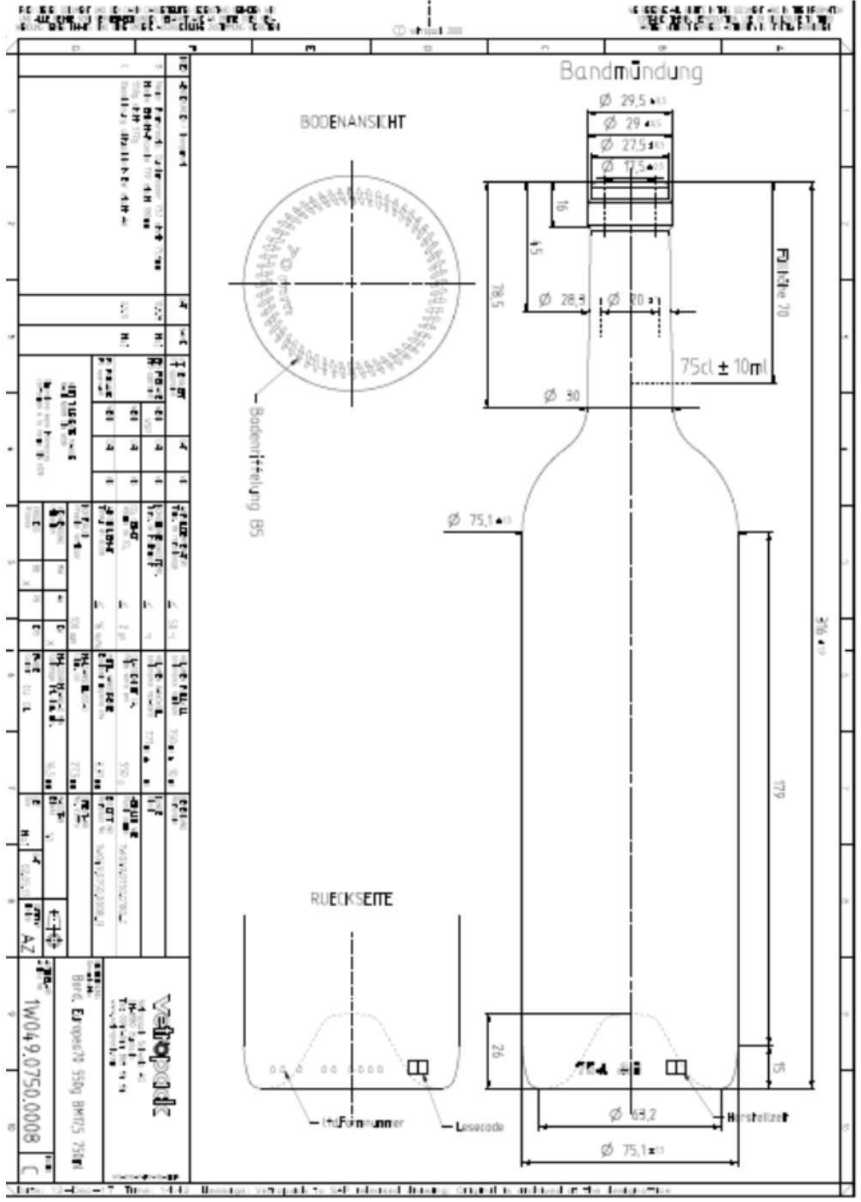
- the fluid flows tangentially to the filtration membrane instead of frontally passing through.
- The separation does not alter the product.





Bottling section





Nominal contents	750 ml
Brimfull	770 ml
Filling Line	70 mm
Height	316 mm
Diameter	75.1 mm
Net Weight	550 g
Finish type group	Cork finish
Finish type	BM17,5
Circulation type	Non returnable
Colour	
Pieces per pallet	1398 PC
Total weight	809 kg
Pallet size	1200 x 1000 x 2080 mm
Pallet type	VMF reutilisation 1200x1000mm

- Length: 39 mm Diameter: 23,5 mm


Plantaže
MALVAZIJA
CRNOGORSKA MALVAZIJA
VRHUNSKO BIJELO VINO
Plantaže
MALVAZIJA
CRNOGORSKA MALVAZIJA
VRHUNSKO BIJELO VINO


20

Chardonnay

UNOAKED CHARDONNAY:

- aged in stainless steel
- won’t impart its rich vanilla flavor in the wine.
- Unoaked Chard has none of those buttery vanilla flavors you might find displeasing.
- Instead it’s just delicious green apple, lemon and maybe even a bit of pineapple.

OAKED CHARDONNAY:

- rich vanilla flavors and the luscious, rich and often rounder mouthfeel the wood aging can often provide.

Krstač

- Light
- Mineral
- Crispy acids
- Refreshing
- Aromas of peach and pear

Sauvignon Blanc

- born in France,
- found a new home in New Zealand
- Chances are most people you know who love Sauvignon Blanc love the New Zealand version:
- smells of fresh cut grass with a nice zippy acidity that is as refreshing as a glass of lemonade.

“Wine is one of the most civilized things in the world and one of the most natural things of the world that has been brought to the greatest perfection, and it offers a greater range for enjoyment and appreciation than, possibly, any other purely sensory thing.”

— Ernest Hemingway

All About Wine

Wine – definition and classification

- *Wine is food product - an alcoholic beverage made with the totally or partly fermented juice of grapes. Technically, wine can be made with any fruit (i.e. apples, cranberries, plums, etc) but most wines are made with wine grapes.*

FROM GRAPE TO GLASS

Virtually every ingredient of a fresh grape can be found in the wine it makes, although additional compounds are produced when wine is made and any sedimented matter is disposed of before it is bottled. The most significant difference in the two lists below is the disappearance of fermentable sugar and the appearance of alcohol, although the constituents will vary according to the variety and ripeness of the grape and the style of wine produced.

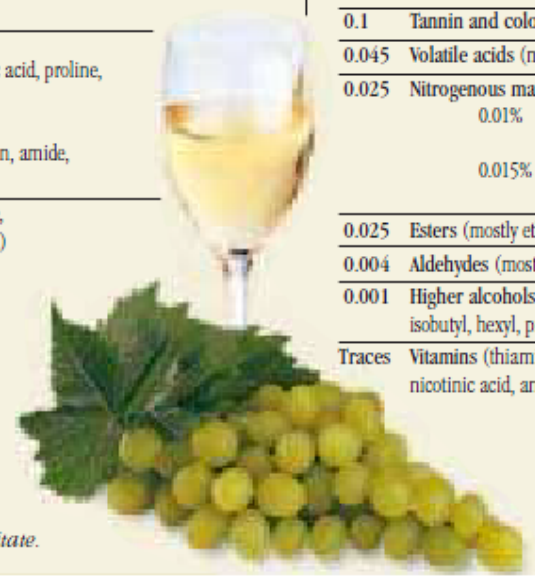
THE "INGREDIENTS" OF FRESH GRAPE JUICE

Percentage by volume

73.5	**Water**	
25	**Carbohydrates**, of which:	
	20%	Sugar (plus pentoses, pectin, inositol)
	5%	Cellulose
0.8	**Organic acids**, of which:	
	0.54%	Tartaric acid
	0.25%	Malic acid
	0.01%	Citric acid (plus possible traces of succinic acid and lactic acid)
0.5	**Minerals**, of which:	
	0.25%	Potassium
	0.05%	Phosphate
	0.035%	Sulfate
	0.025%	Calcium
	0.025%	Magnesium
	0.01%	Chloride
	0.005%	Silicic acid
	0.1%	Others (aluminum, boron, copper, iron, molybdenum, rubidium, sodium, zinc)
0.13	**Tannin and color pigments**	
0.07	**Nitrogenous matter**, of which:	
	0.05%	Amino acids (arginine, glutamic acid, proline, serine, threonine, and others)
	0.005%	Protein
	0.015%	Other nitrogenous matter (humin, amide, ammonia, and others)
Traces	**Mainly vitamins** (thiamine, riboflavin, pyridoxine, pantothenic acid, nicotinic acid, and ascorbic acid)	

WATER INTO WINE

The individual flavoring elements in any wine represent barely two percent of its content. Although we can determine with great accuracy the amount and identity of 99 percent of these constituents, the mystery is that if we assembled them and added the requisite volume of water and alcohol, the result would taste nothing like wine, let alone like the specific wine we would be trying to imitate.



THE "CONTENTS" OF WINE

Percentage by volume

86	**Water**	
12	**Alcohol** (ethyl alcohol)	
1	**Glycerol**	
0.4	**Organic acids**, of which:	
	0.20%	Tartaric acid
	0.15%	Lactic acid
	0.05%	Succinic acid (plus traces of malic acid citric acid)
0.2	**Carbohydrates** (unfermentable sugar)	
0.2	**Minerals**, of which:	
	0.075%	Potassium
	0.05%	Phosphate
	0.02%	Calcium
	0.02%	Magnesium
	0.02%	Sulfate
	0.01%	Chloride
	0.005%	Silicic acid
	Traces	Aluminum, boron, copper, iron, molybdenum, rubidium, sodium, zinc
0.1	**Tannin and color pigments**	
0.045	**Volatile acids** (mostly acetic acid)	
0.025	**Nitrogenous matter**, of which:	
	0.01%	Amino acids (arginine, glutamic acid, proline, serine, threonine, and others)
	0.015%	Protein and other nitrogenous matter (humin, amide, ammonia, and others)
0.025	**Esters** (mostly ethyl acetate, but traces of numerous others)	
0.004	**Aldehydes** (mostly acetaldehyde, some vanillin, and traces of others)	
0.001	**Higher alcohols** (minute quantities of amyl plus traces of isoamyl, butyl, isobutyl, hexyl, propyl, and methyl may be present)	
Traces	**Vitamins** (thiamine, riboflavin, pyridoxine, pantothenic acid, nicotinic acid, and ascorbic acid)	

Wine classification

According to Law of Montenegro there are:

- Still wines – which do not have CO_2, therefore in glass there are no bubbles.
- Sparkling wines – which contain certain amount of CO_2.
- Pearl wine - Semi-sparkling wines are defined as those with between 1 and 2.5 atmospheres of pressures and include German spritzig, Italian frizzante and French pétillant wines.
- Liqueur (fortified) wines - is a wine to which a distilled spirit, usually brandy, is added. Many different styles of fortified wine have been developed, including Port, Sherry, Madeira, Marsala, Commandaria wine, and the aromatised wine Vermouth.

Wine classification

Based on the colour there are:

- White wines – made of white or black grape;
- Rose wines – made of black grape with shortterm maceration;
- Red wines – made of only black grape.

Based on sugar content:

- Still wines can be: dry (<4 g/L), semidry (4-12 g/L), semisweet (12-50 g/L) and sweet (>50 g/L);
- Sparkling and semi-sparkling wines can be: extra-dry, dry, semi-dry, semi-sweet and sweet.

Based on quality and geographic origin there are:

- Table wines,
- Table wines with controlled geographic origin and
- Quality wines produced in specified regions.

New World and Old World Wine

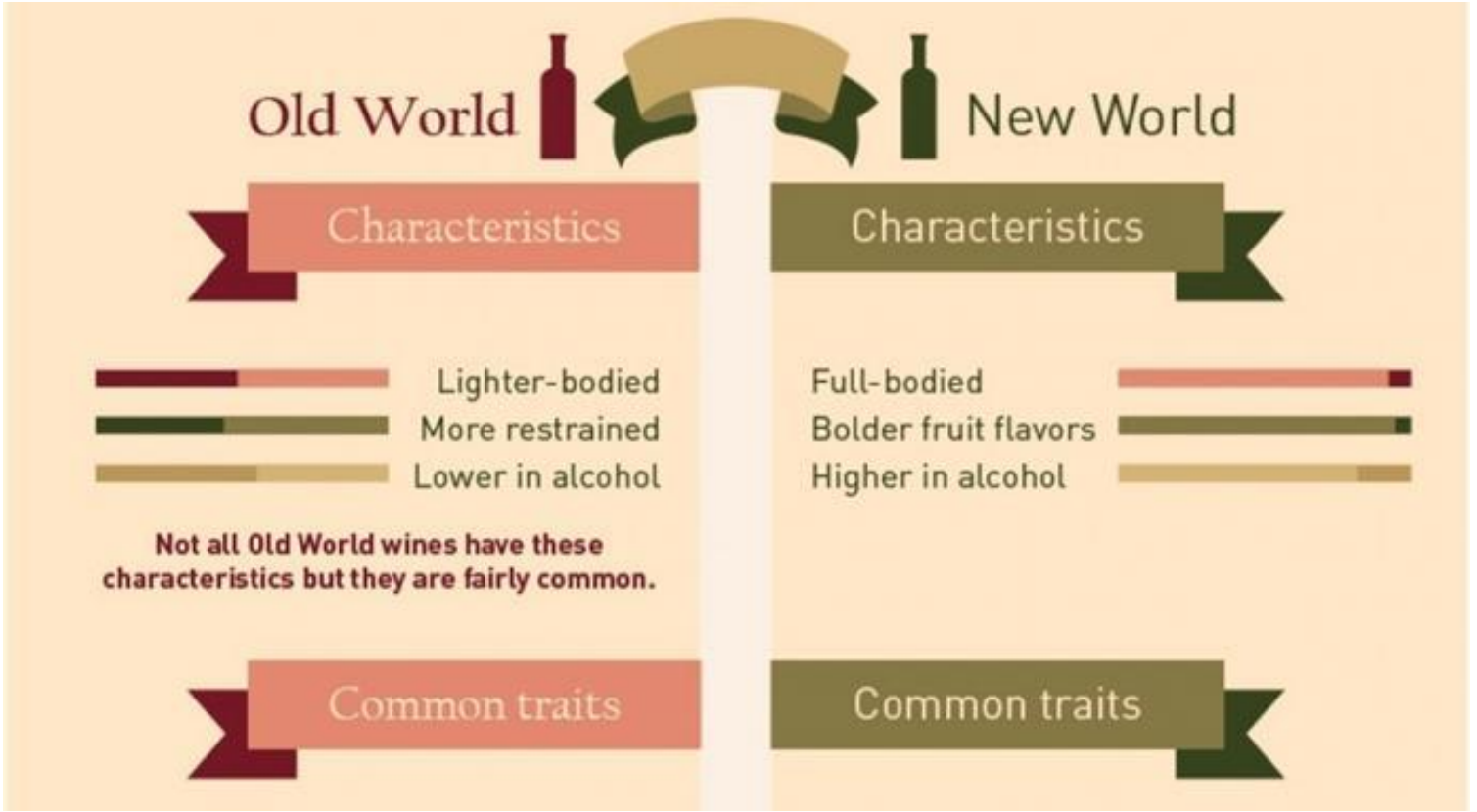
- Beside mentioned classification there is also classifictaion to the wine from Old and New World, based on its geographic origin.

- ***Old world wines come from countries or regions where winemaking (with Vitis vinifera grapes) first originated*.**
- For example, France, Italy, Spain, Portugal, Greece and Germany are Old World wine countries that have made wine for thousands of years. Also, based on the definition, countries like Turkey, Georgia, Armenia and Moldova are Old World wine regions as well.

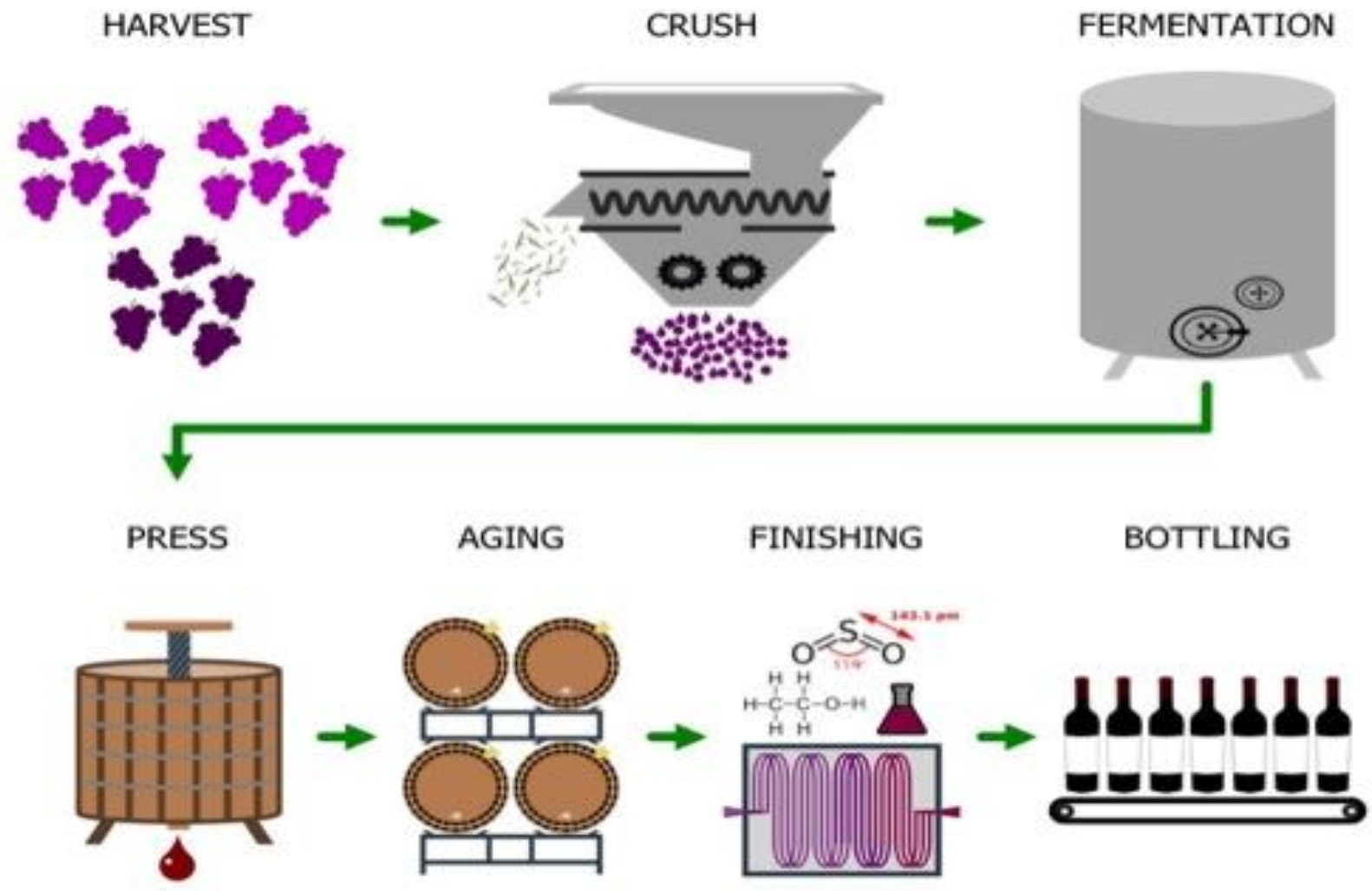
- ***New World Wine: wines from countries or regions where winemaking (and Vitis vinifera grapes) were imported during and after the age of exploration.***
- For example, the United States, Australia, South Africa, Chile, Argentina and New Zealand are New World wine regions. Also, based on the definition, China, India and Japan are New World wine regions

New World vs Old World Wine

- **Old World** wines are often described as tasting lighter, having less alcohol, having higher acidity, and tasting less fruity
- **New World** wines are often described as tasting riper, having higher alcohol, having less acidity, and tasting more fruity



How Wine Happens



The Harvest

- This is a **critical** point during the winemaking cycle when the grapes are picked and transferred to the winery. It is sometimes referred to as ‘vintage’.
- The grower/producer must decide upon the ripeness of the grapes and when to pick. In the northern hemisphere, picking can begin in late August through to late October or even November depending on the mesoclimate and the year’s weather. In the southern hemisphere, picking can start in late January through to May.

Grape ripeness and the timing of picking

- The aim is to achieve ***physiological*** ripeness, which is not simply a matter of **sugar and acidity**, but also of **tannins** and **flavour** compounds.
- On black grape varieties, a lot can be determined by tasting the grape and examining the seed, which should be completely brown.
- In the weeks and days preceding harvest, the grapes are tested regularly for sugar content.
- The time of picking is one of the most crucial decisions a grower will make during the vineyard year. This decision is usually jointly made between the grower and the winemaker, unless they are one and the same person.

Harvesting methods

- There are two basic methods of picking: hand and mechanical.
- In some European regions, wine laws only allow hand picking. Grapes start to deteriorate from the moment they are picked. The method of picking used affects the style and quality of the finished wine.
- Essentially, the difference is between slow and selective hand picking and the speed of machine harvesting. There are advantages and disadvantages to each method, and the choice may depend on several factors.

Hand picking

- This method can be used whatever the training system in the vineyard and on all terrains.
- Of course pickers' labour costs can be substantial, and the team will need housing and feeding.
- Picking by hand is essentially the cutting of part or whole bunches. It is possible to be very selective: damaged parts of the bunch or even individual rotten berries may be removed.

Machine picking

- The capital cost is substantial – it is not just the cost of the machines but also the preparation of the vineyard with wide rows and the installation of appropriate trellis training systems.
- The berries are picked by being vibrated off the vines and are collected in a reception hopper. The vibrating arms can cause damage to vines and even the trellis system.
- Also, mechanical harvesters can operate 24 hours a day and have the advantage of being able to undertake picking at night. This is important in hotter regions, ensuring that rapes are picked at cool temperatures and delivered to the winery in good condition.
- A disadvantage of mechanical harvesting is that the process is unselective – the machine is unable to distinguish between healthy and diseased grapes. The action of machines means that only berries can be picked and not whole bunches.

- the method of picking and handling of the grapes, the timing and the speed of their arrival at the winery, will impact on the ***style*** and ***quality*** of the finished wine. If the grapes are damaged, oxidation will set in and prolonged skin contact with the juice, particularly for white wines, can lead to excessive phenolics and the loss of aromatics.

How Wine Happens

Wine is, essentially, nothing but liquid, fermented fruit. The recipe for turning fruit into wine goes something like this:

1. Pick a large quantity of ripe grapes from grapevines.
You could substitute raspberries or any other fruit, but **99.9** percent of all the wine in the world is made from grapes, because they make the best wines.

2. Put the grapes into a clean container that doesn't leak.

3. Crush the grapes somehow to release their juice.
Once upon a time, feet performed this step.

4. Wait.

Vinification - Alcoholic fermentation

- In its most basic form, ***winemaking*** is that simple. After the grapes are crushed, *yeasts* (tiny one-celled organisms that exist naturally in the vineyard and, therefore, on the grapes) come into contact with the sugar in the grapes' juice and gradually convert that sugar into alcohol. Yeasts also produce carbon dioxide, which evaporates into the air. When the yeasts are done working, your grape juice is wine. The sugar that was in the juice is no longer there — alcohol is present instead. (The riper and sweeter the grapes, the more alcohol the wine will have.).
- This process is called *fermentation.*

$$C_6H_{12}O_6 \longrightarrow 2C_2H_5OH + 2CO_2$$

Modern winemaking

- controlling the type of container used for the fermentation process (stainless steel and oak are the two main materials), as well as the size of the container and the temperature of the juice during fermentation — and every one of these choices can make a big difference in the taste of the wine.
- After fermentation, we can choose how long to let the wine *mature* (a stage when the wine sort of gets its act together) and in what kind of container. Fermentation can last three days or three months, and the wine can then mature for a couple of weeks or a couple of years or anything in between.
- If you have trouble making decisions, don’t ever become a winemaker.

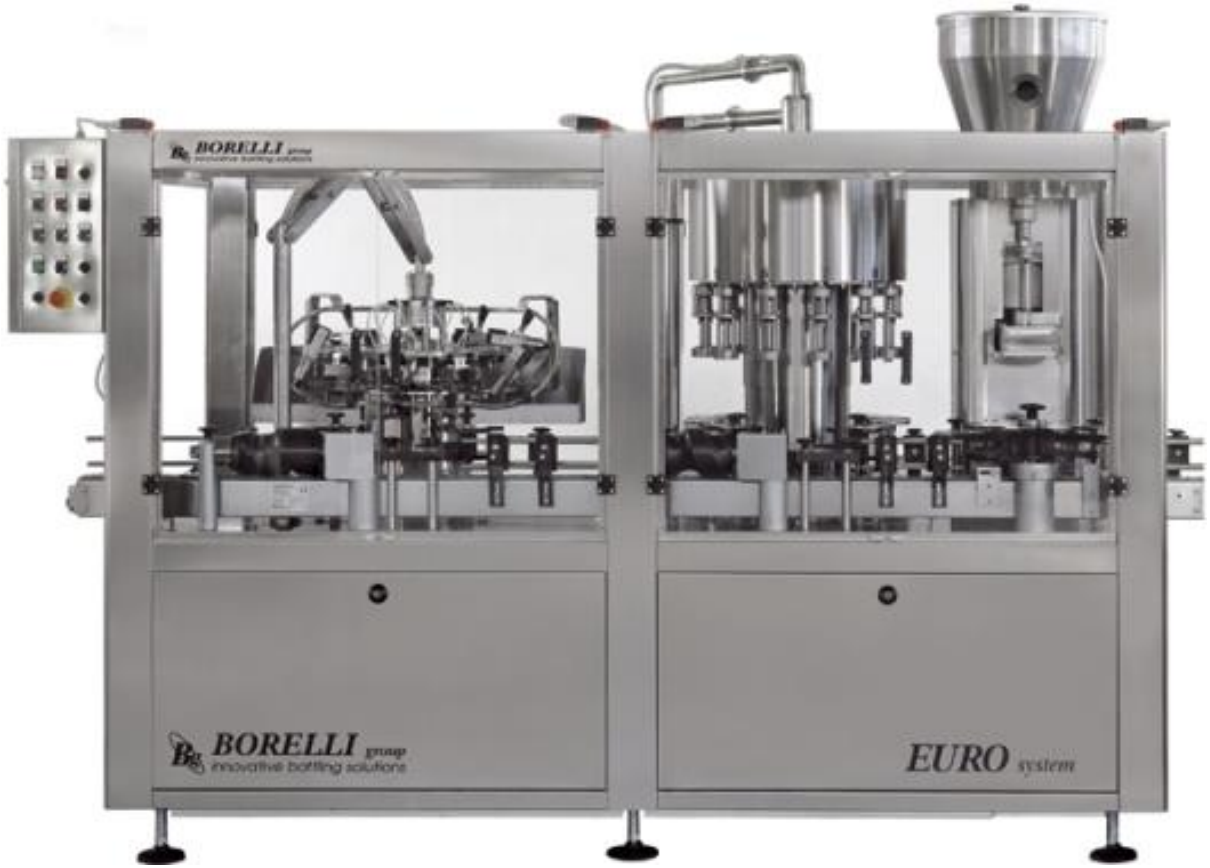
Winery equipment

- crusher/destemmer(s)
- fermentation and storage vats
- press(es)
- Pumps
- fixed and moveable pipes and hoses
- Filters
- refrigeration equipment
- barrels, if utilized
- bottling line, if wine is to be bottled on the property
- laboratory equipment
- cleaning equipment.

crusher/destemmer

crusher/destemmer

Press – *used for pressing grape pomace*



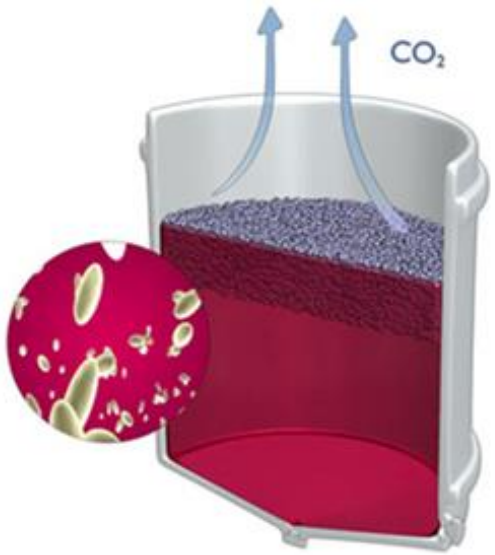
Bottling line

Red Wine Making

- Red wines are made from grapes that are red or bluish in color.
- The red color occurs when the colorless juice of red grapes stays in contact with the dark grape skins during fermentation and absorbs the skins' color. Along with color, the grape skins give the wine *tannin,* a substance that's an important part of the way a red wine tastes. The presence of tannin in red wines is actually the most important taste difference between red wines and white wines.

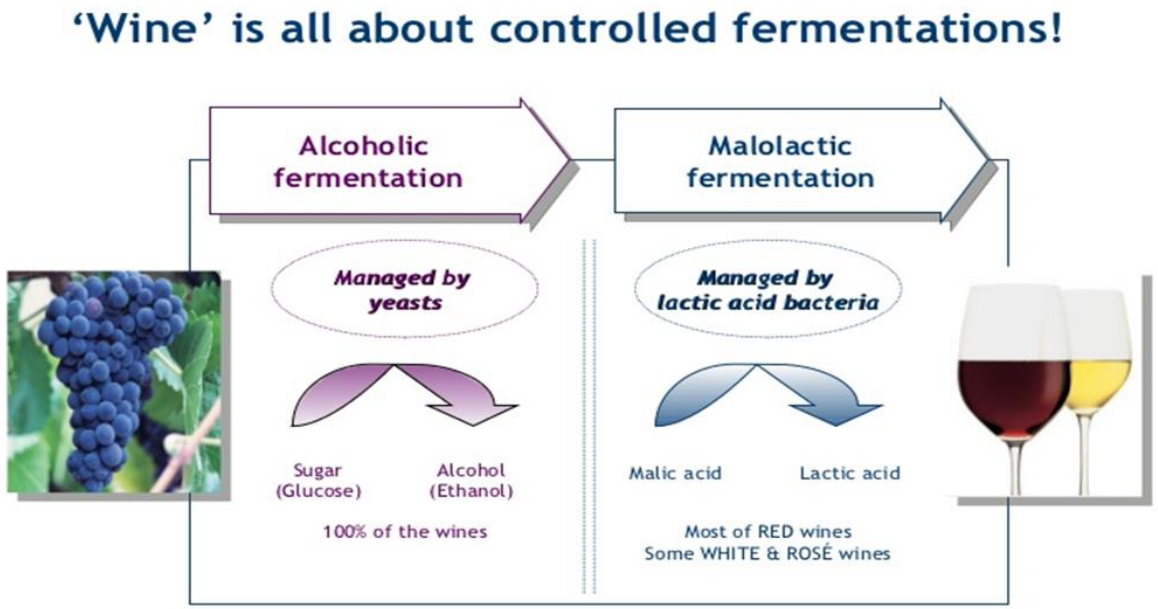
Red Wine Making

- Fermentation of red wine usually occurs at higher temperature (18-24 °C) and it lasts about 7-15 days, all time in contact with grape skin.
- Consequently, during the process, the juice is drawn out from near the bottom of the vat and pumped up and sprayed over the cap to submerge it. This process, known as remontage, has the additional benefit of aerating the must, which helps to boost the yeast colonies.



Malolactic fermentation

- This usually follows the alcoholic fermentation and so is sometimes referred to as secondary fermentation.
- The aim of malolactic fermentation may follow alcoholic fermentation to soften any aggressive acidity.
- It gives the wine a slight 'buttery' and/or toasty nose and sometimes a certain amount of complexity.
- Some white grape varieties, e.g. Chardonnay, work well with malolactic fermentation, whereas others may not. Other varieties which are valued for their crisp acidity, such as Riesling or Sauvignon Blanc, do not usually undergo malolactic fermentation.

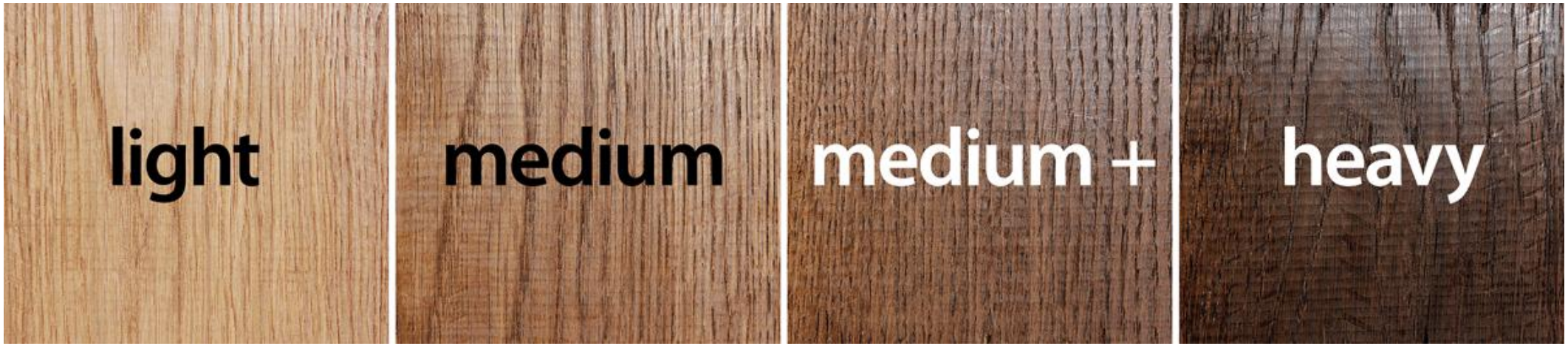


Maturation

- ***RED WINE***
- Immediately after fermentation, wines may taste rough and fairly unpleasant. A period of maturation is required during which the tannins soften and acidity levels fall. The choice of maturation vessel and the period of time depend upon the style of wine to be produced and quality and cost factors.
- Most high quality red wines undergo a period of barrel maturation – usually somewhere between 9 and 22 months. During the time in barrels, the wine will undergo a controlled oxygenation and absorb some oak products, including wood tannins and vanillin. Barrel size has an effect on the maturation of the wine; the smaller the barrel the quicker the maturation. Temperature also plays an important part; the lower the temperature, the slower the maturation.

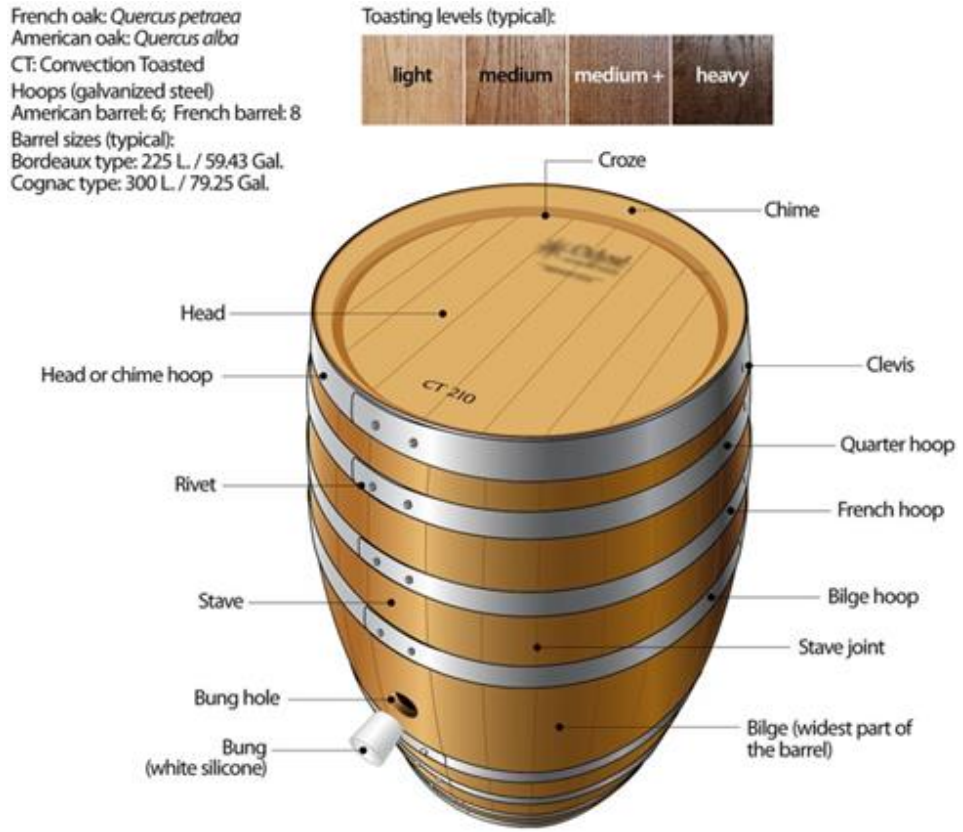
Barrel Maturation and Oak Treatments

- There is no doubt that oak maturation is very fashionable.
- *Origin of oak: franch, american, hungarian, slavonian...*
- Type of oak: Toasting is one operation in the barrel-making process that has a very direct effect on the taste of the wine.



Barrel Maturation and Oak Treatments

- A ***barrique*** is a barrel or cask, and the term typically refers to a particular size and shape of a barrel. The *barrique* originated in bordeaux, and it traditionally holds 225 liters. It is the most common type of wine barrel.



Oak alternatives

- Maturation of wines in new oak barrels is an expensive process. It is not just the high cost of the barrels, but also the extra labour in racking and working with small individual batches.

- For this reason, new inexpensive techniques have been developed to simplify the ageing process, while ensuring that the wood-related volatiles are released into the wine and with sensory properties similar to wines aged in barrels. These alternatives include oak chips, shavings and larger pieces of oak





- Blending - The mixing of several wines to create a balanced cuvée

WHY?

- To enhance aroma
- To improve the color
- To add or minimize flavors and tastes
- To adjust the pH of a wine
- To lower or raise acidity
- To raise or lower alcohol levels
- To adjust the sweetness of a wine
- To correct a wine with too much oak flavor
- To raise or lower levels of tannin

WINE WARS

THE WINE FORCE AWAKENS

Special wines

Strawberries cherries and an angel's kiss in spring
My summer wine is really made from all these things...

Lana DelRey

Special wines

- Special wine is a product made with particular processing of grapes or natural wine with addition of needed amount of sugar, alcohol, some other flavour ingedients which are not harmful to human health.
- Special wines are divided:
- Dessert wines,
- Liquor wines and
- Aromatizied wines.
- Special wines contain at least 15 (%vol) of alcohol.

Dessert wines

- Late harvest
- Fortified wines
- Noble rot
- Ice wine

Dessert wines - Late Harvest Wines

- Late Harvest Dessert Wine is made from grapes (most often Riesling, Muscat, Pinot Gris, and Gewürztraminer varities) that have been left on the vine until they are extremely ripe and sweet. During the fermentation process, the yeast working to convert the extra sweet juice into alcohol dies off before it can process all the sugar, resulting in a sweeter wine.

Dessert wines - Noble Rot Wines

- While it doesn't *sound* delicious, some of the most sought after dessert wines in the world are made from grapes that are, well…rotten.
- The fruit is covered in a fungus called *Botrytis cinerea*, also known as "noble rot," which surrounds the grape and causes it to shrivel, leaching out much of the water and leaving behind extra sweet pulp, which the winemakers then press for juice.
- Making this type of dessert wine is a labor intensive, painstaking process.

Liquor wines - Fortified Wines

- Fortified dessert wines such as Sherry, Port, and Madeira are made by adding alcohol to still wine during the fermentation process.
- The addition of alcohol stops fermentation by killing the yeast, leaving behind residual, unfermented sugar from the grapes.
- The result is a sweet wine with an alcohol content of 15 to 20 percent. Port is a popular fortified dessert wine with a deep red color and rich, ripe flavors of dark berries, plums, and spices.

Liquor wines - Fortified Wines

PORT

- Port wine is made in the Northern part of Portugal along the Douro river. These rare sweet red wines are made with dozens of Portuguese traditional grapes including Touriga Nacional, Touriga Franca, and Tinta Roriz. The grapes are collected and fermented together in open tanks where the grapes are stomped daily as the wine begins to ferment.
- At a point during the fermentation, the wine is strained and blended with a clear grape spirit (with nearly 70% ABV) that stops fermentation and fortifies the wine. After this process, there are a series of winemaking steps that lead into the different styles.

Liquor wines - Fortified Wines

- ***Sherry*** comes from Andalusia, Spain. The wines are made using Palomino, Pedro Ximénez (a grape, not a person), and Moscatel grapes.
- Wines are produced using varying amounts of the three grapes and are purposefully oxidized so that they develop nutty aromatics.

Liquor wines - Fortified Wines

- ***Madeira***
- Madeira is a wine produced using up to 4 different grapes on the island in the middle of the Atlantic Ocean. Madeira is very unlike other wines because, in order to produce it, the wines undergo a heating and oxidation process – techniques that would traditionally "ruin" a wine.
- The result is a rich fortified wine with walnut-like flavors, salinity and an oiliness on the palate.

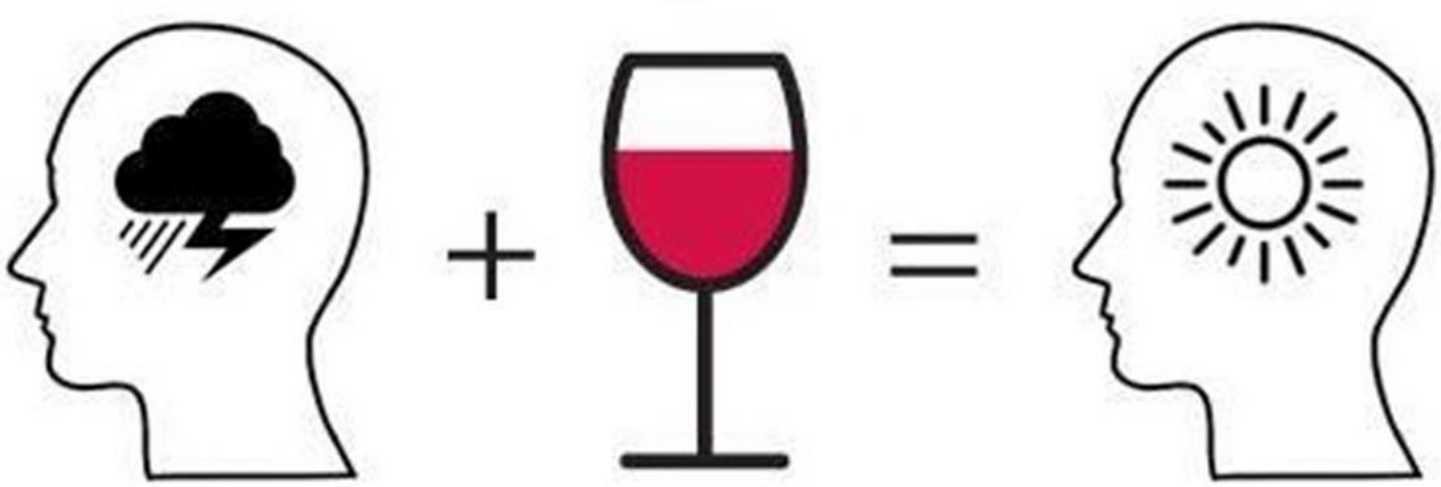
Dessert wines – Ice Wines

- Freezing grapes (-7 °C) is another way to concentrate sugars to make sweet wine.
- When made in the traditional way, ice wine, or “eiswein” as it is called in Germany and Austria, is left on the vine long after the typical harvest is finished until temperatures drop enough for the grapes to freeze.
- Workers then race to pick the frozen grapes and press them carefully so that the water content is separated (as ice) from the sweet nectar that will become the wine. Making wine this way is risky.

Aromatized wines

- By definition, aromatized wines are wines flavored with fruit, spices, and florals in addition to added alcohol.
- As aperitives
- Vermouth is officially classified as an ‘aromatized fortified wine’, a tongue-twisting term meaning a base white wine fortified and infused with a proprietary recipe of different plants, barks, seeds, fruit peels, collectively known as botanicals

Hope that you have enjoyed

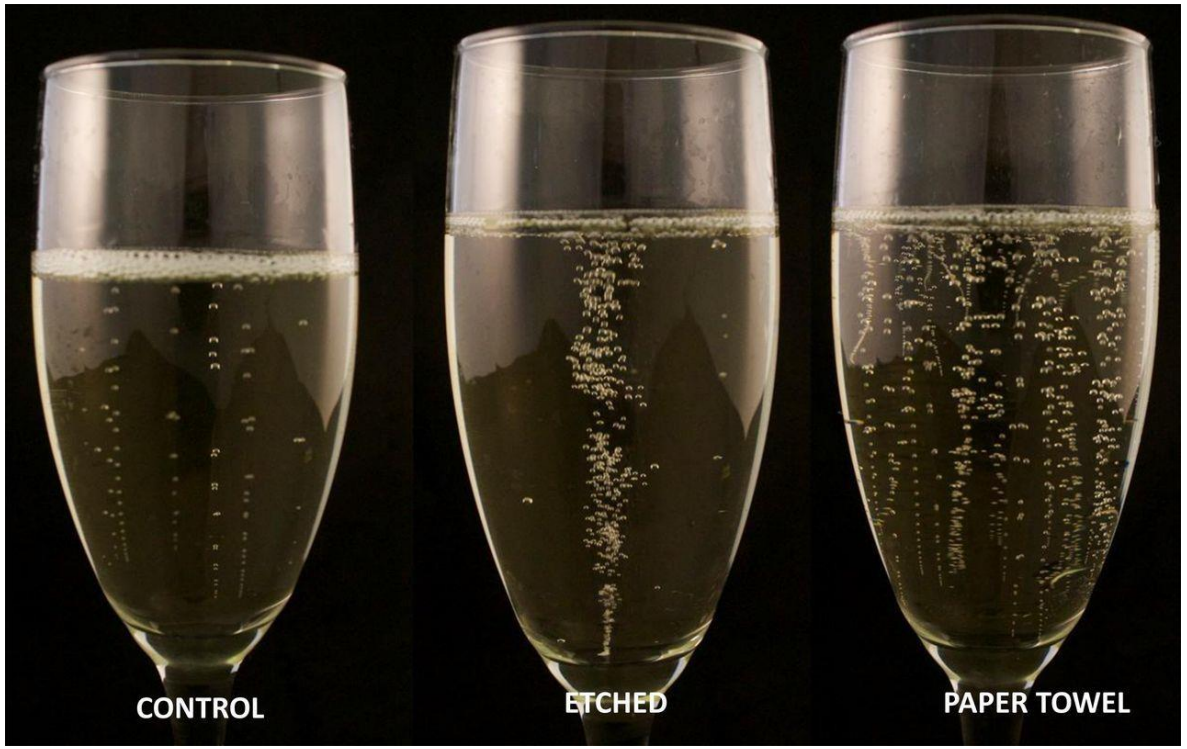


KNOW YOUR BUBBLES
Sparkling wines

Sparkling Wines

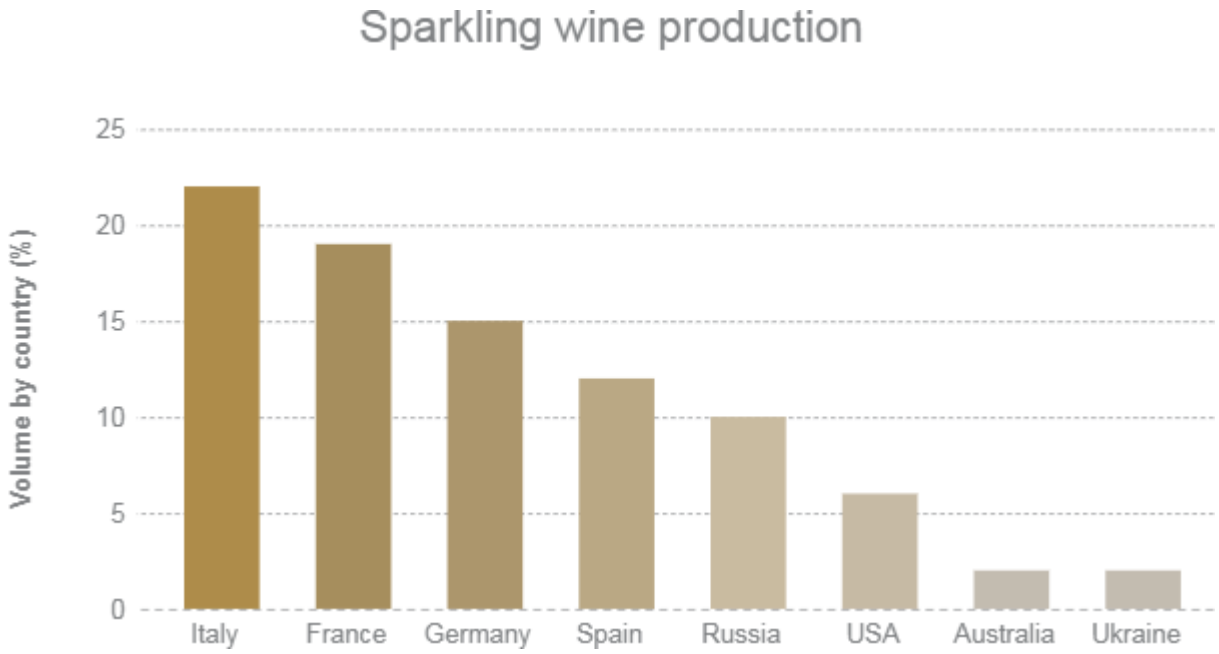
Sparkling wines are distinguished (and distinguishable) from other wines by the presence of bubbles – carbon dioxide – in the wine.

- The excess pressure of this gas in the bottle is at least 3.5 bars at 20°C.
- Nevertheless, for bottles of a capacity less than 0.25 l, the minimum excess pressure is 3 bars at 20°C.



worldwide production of sparkling wines

With 86% of the world production, Europe is from far the leader. Italy holds the first position (22%), followed closely by France (19%), Germany (15%), Spain (12%), Russia (10%) and the USA (6%).

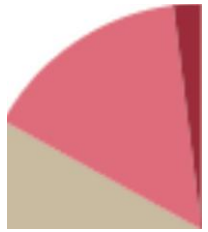


In terms of consumption, Germany, Russia and the USA are the biggest sparkling wine consumers, but the UK is the number one in value terms. The worldwide consumption should increase of 10% over the next three years.

SPARKLING wine styles

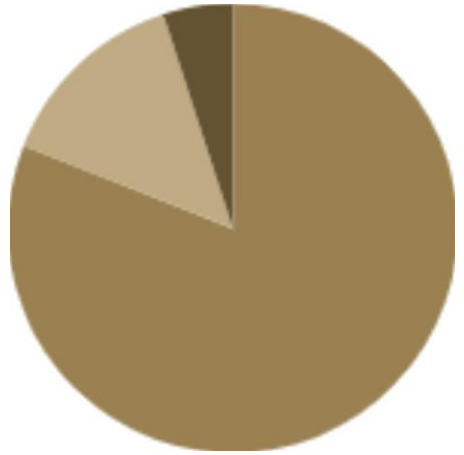
- Brut Nature *0-3 g/l Residual Sugar (RS) - tatally dry*
- Extra Brut *0-6 g/l RS - estra dry*
- Brut *<12 g/l RS - dry*
- Extra Dry *12-17 g/l RS - semi-dry*
- Dry *17-32 g/l RS - slightly - sweet*
- Demi-Sec *32-50 g/l RS - sweet*
- Doux *50+ g/l RS - very sweet*

Share of volume by colour



White (836) Rosé (156) Red (26)

Share of volume by dosage



B% (816) % Demi-sec (146) Extra-b% (59)

Introduction

- Champagne, the sparkling wine of Champagne, France, is the gold standard of sparkling wines for a number of reasons:
- Champagne is the most famous sparkling wine in the world; the name has immediate recognition with everyone, not just wine drinkers.
- A particular technique for making sparkling wine was perfected in the Champagne regic
- Champagne is usually made from
- Chardonnay,
- Pinot Noir and
- Pinot Meuinier.

Introduction

Father of champagne

- Dom Perignon was a Benedictine monk at Abbey of Hautvilliers who at the age of 30 in 1688 was appointed the cellar master & treasurer at the Abby of Hautvillers.
- Died in 1715 after 47 years at the Abby.

Come qickly, I am drinking stars!

Dom Perignon

The Methods of Producing Sparkling Wine

- Most sparkling wines go through ***two fermentations***: one to turn the grape juice into ***still wine without bubbles*** (that's called a **base wine**) and a subsequent one to turn the base wine into bubbly wine.
- The winemaker instigates the second fermentation by adding yeasts and sugar to the base wine. The added yeasts convert the added sugar into alcohol and carbon dioxide (CO_2) bubbles.

The Methods of Producing Sparkling Wine

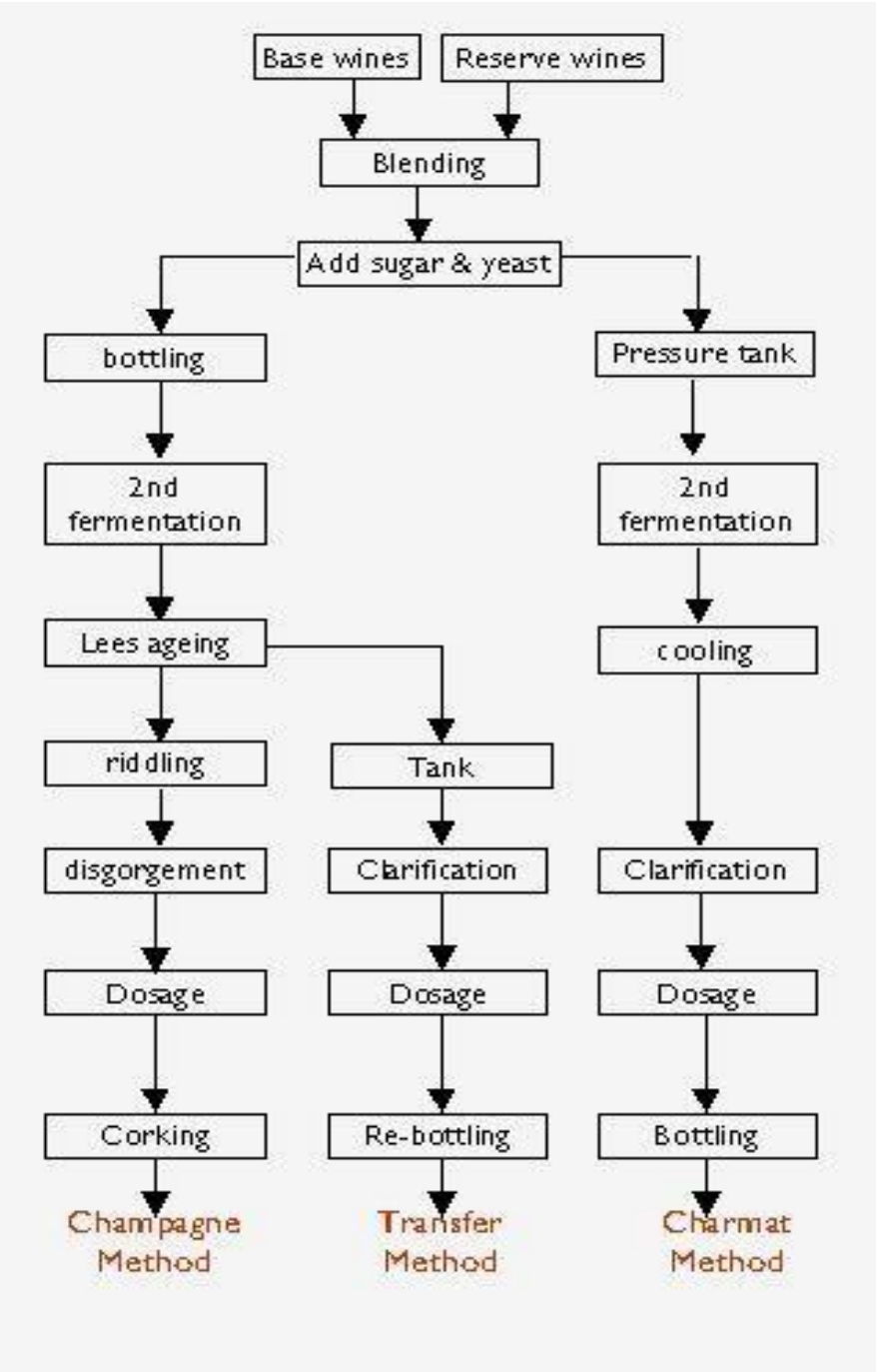
- Beginning with the second fermentation, the longer and slower the winemaking process, the more complex and expensive the sparkling wine will be. Some sparkling wines are ten years in the making; others are produced in only a few months. The slow-route wines can cost more than $100 a bottle, while bubblies at the opposite end of the spectrum can sell for as little as $4.

How Sparkling Wine Happens

There are 4 methods for sparkling wine production:

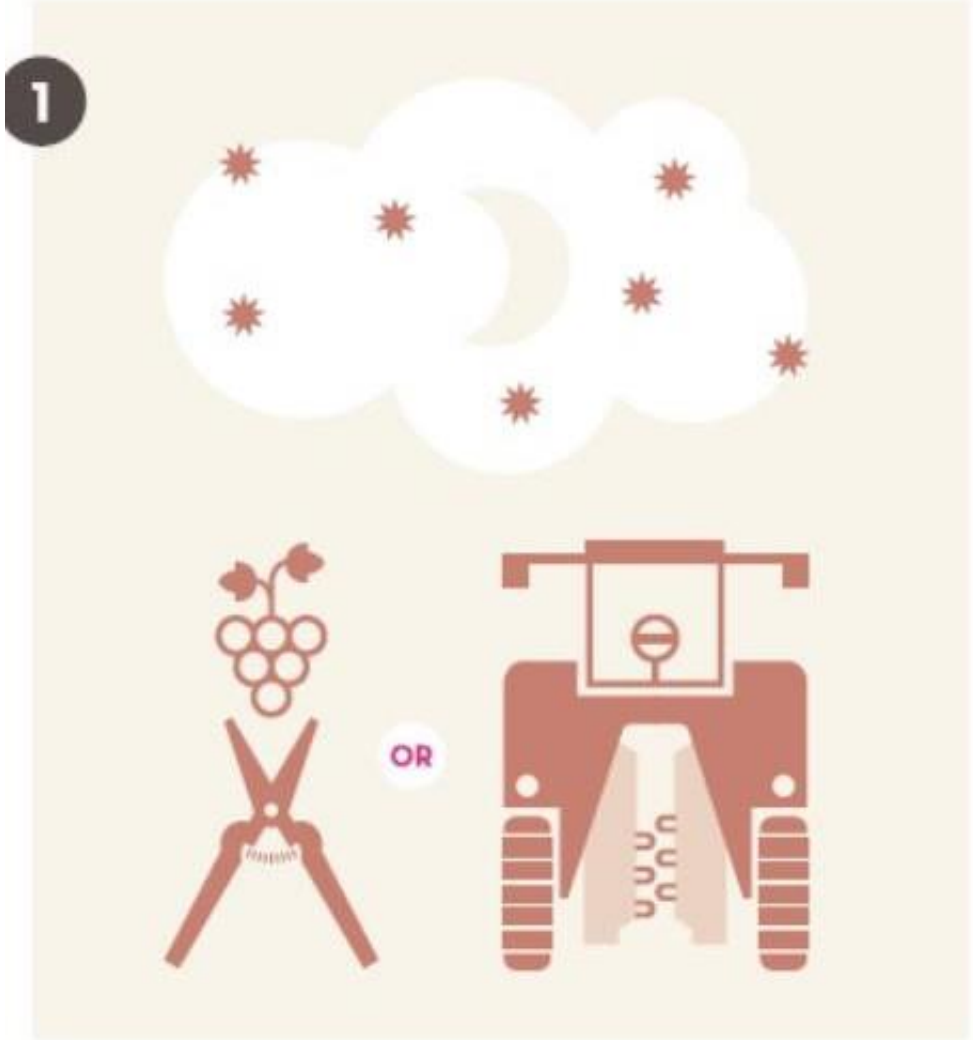
1. **Traditional method or Methode Champenoise (Champagne is produced only in this way)**
2. **Transfer method**
3. **Charmat method**
4. **Carbonization**

Sparkling wines made by charmat method contain press of 3-3.5 bars, while wines made by traditional method contain press in the bottle to the 6 bars.



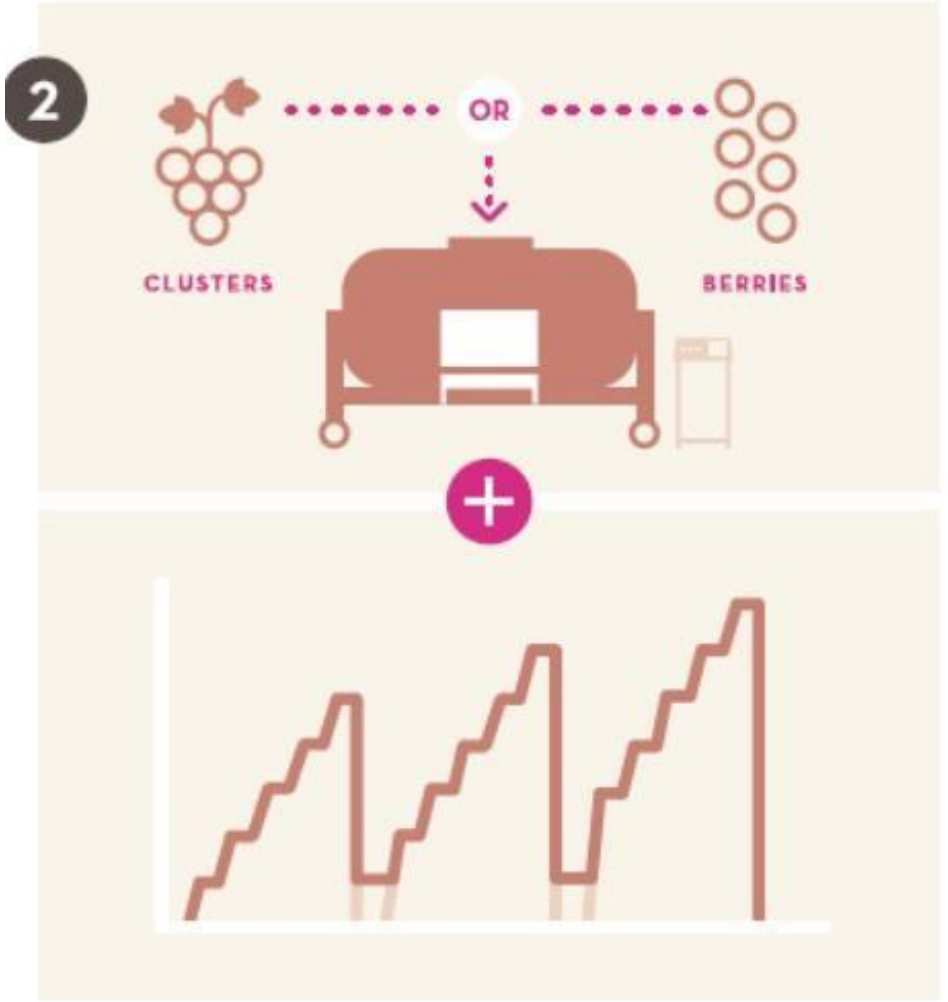
HARVEST

- Grapes destined for sparkling wine are harvested at a low brix level (17–21°) to keep the acidity and flavors bright
- It is optimal to pick in the early morning or at night while the temperature is cool.
- Grapes may be hand harvested or machine harvested.
- When filling bins, it is recommended that smaller bins be used and they should not be filled all the way to the top, as the weight of the fruit will start to extract juice and oxidation will readily occur.



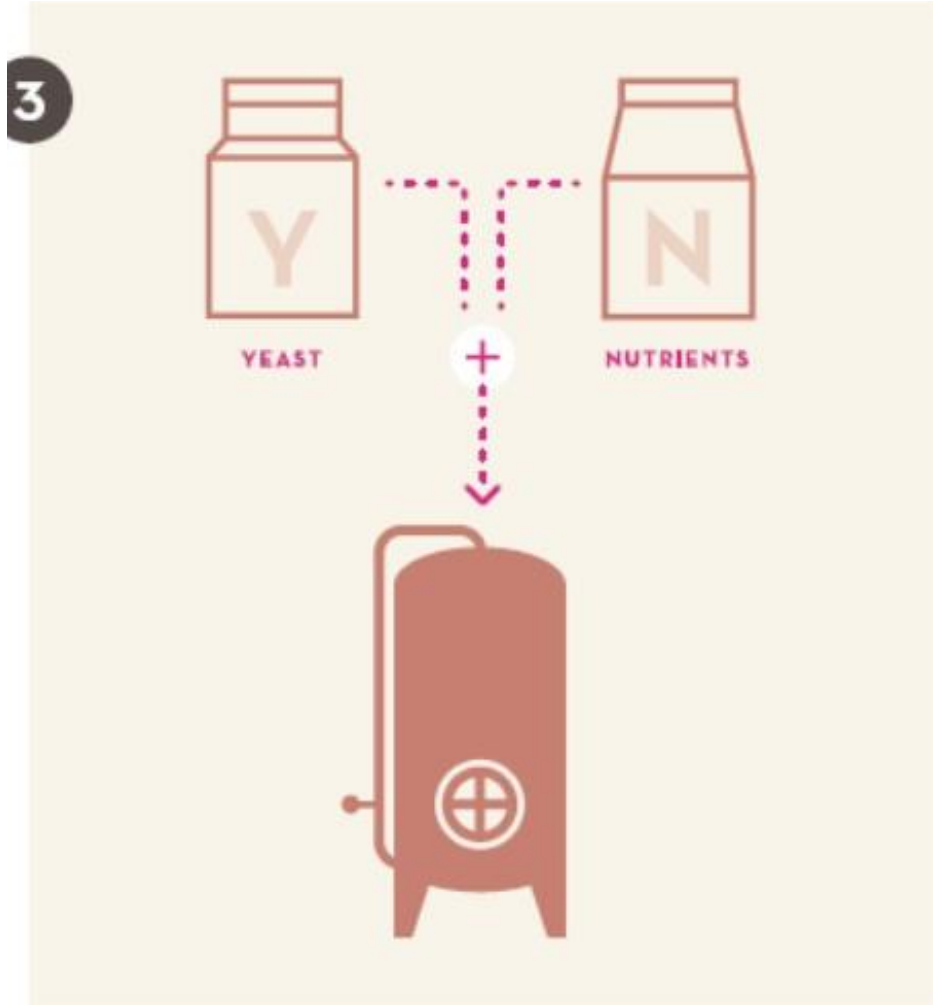
PRESSING

Pressing is a crucial step in the sparkling process.
In order to ensure the quality of the juice, it is recommended to press whole cluster grapes.
This produces must that has a low level of phenolic extraction. A gentle, gradual increase in pressure is recommended. Many industrial presses have programs specifically for crémant or sparkling wine already installed.



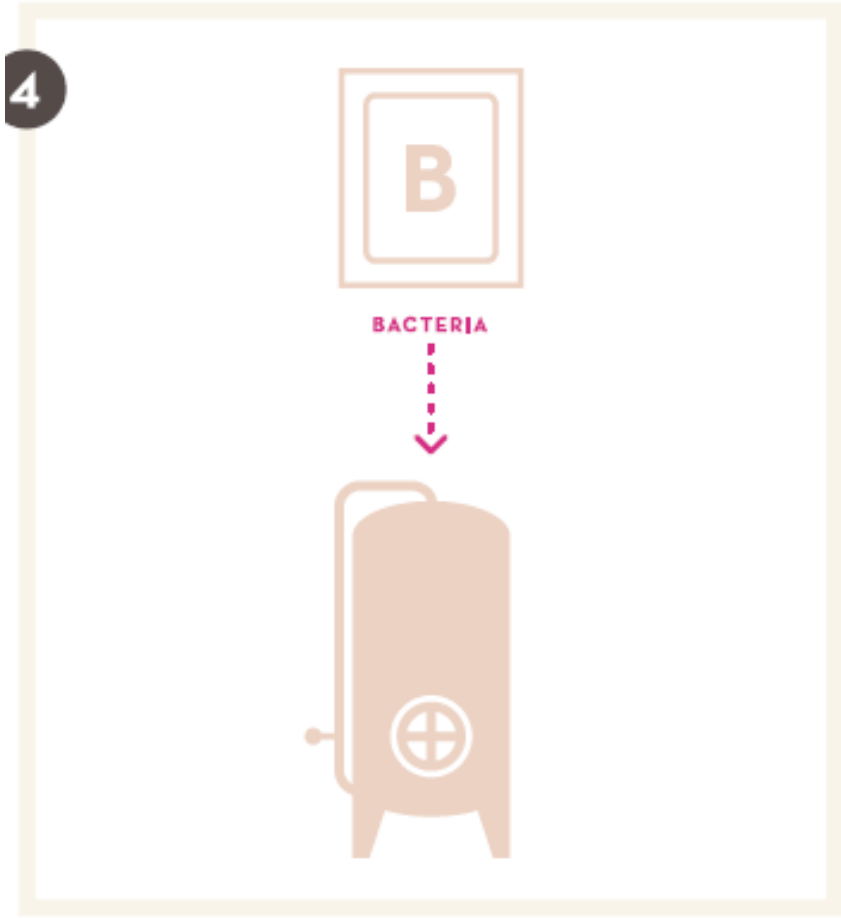
Primary fermentation

In order to start the primary alcoholic fermentation, a combination of yeast and nutrients are added to the must.
Primary fermentation is typically always done in a stainless steel tank.



Malolactic fermentation

- Malolactic fermentation (MLF) is dependent upon winemaker preference. Conducting MLF on the base wine helps to soften high-acid wines and reduces the malic acid for better microbial stability.
- It is common to put a portion of the base wine through MLF and then blend it with wine that has not undergone MLF in order to achieve a balance of acidity, freshness, rounded mouthfeel and fruity aromas.

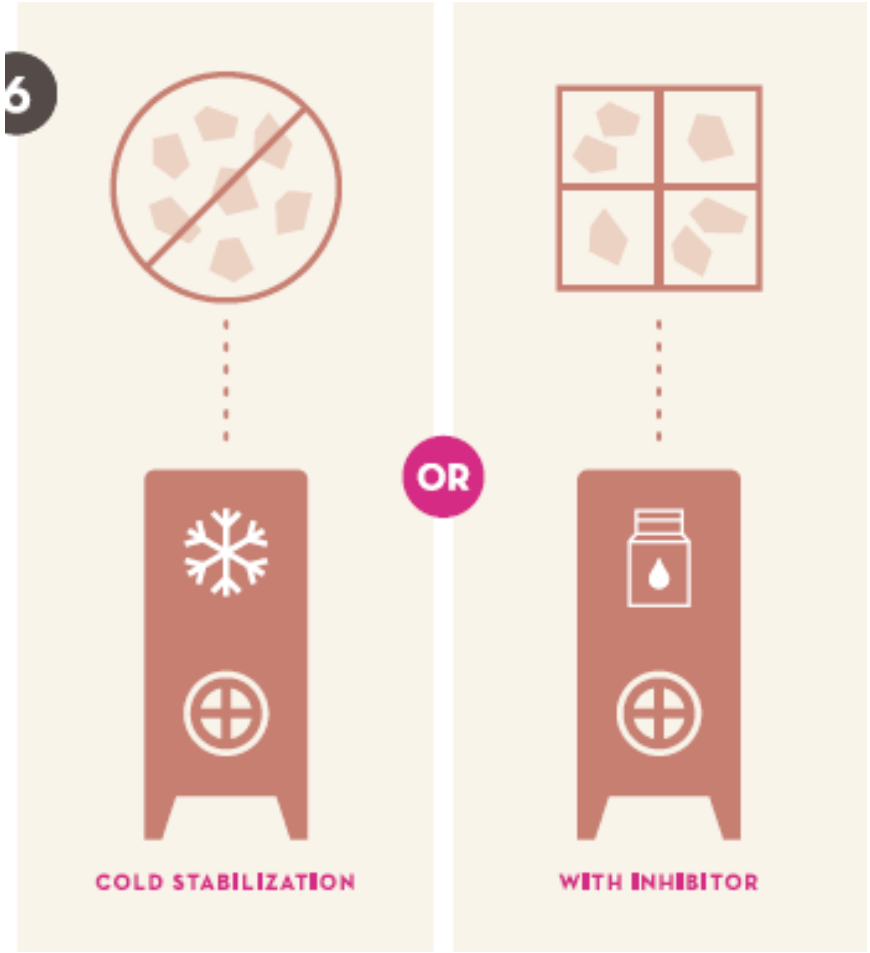


Blending

Blending is not necessary, but it is considered by some to be the most important step to achieve a finished wine that is well balanced. By blending wines with different sensory attributes, the winemaker can create a finished sparkling wine with more complex aromas and flavors.

Stabilization of tartarate

- The formation of potassium or calcium tartrate crystals can be detrimental, as they are unsightly and can cause gushing (loss) of the finished wine.
- Tartrate stabilization can be achieved by **cold stabilization** or by the use of inhibitory products which inhibit crystal formation.



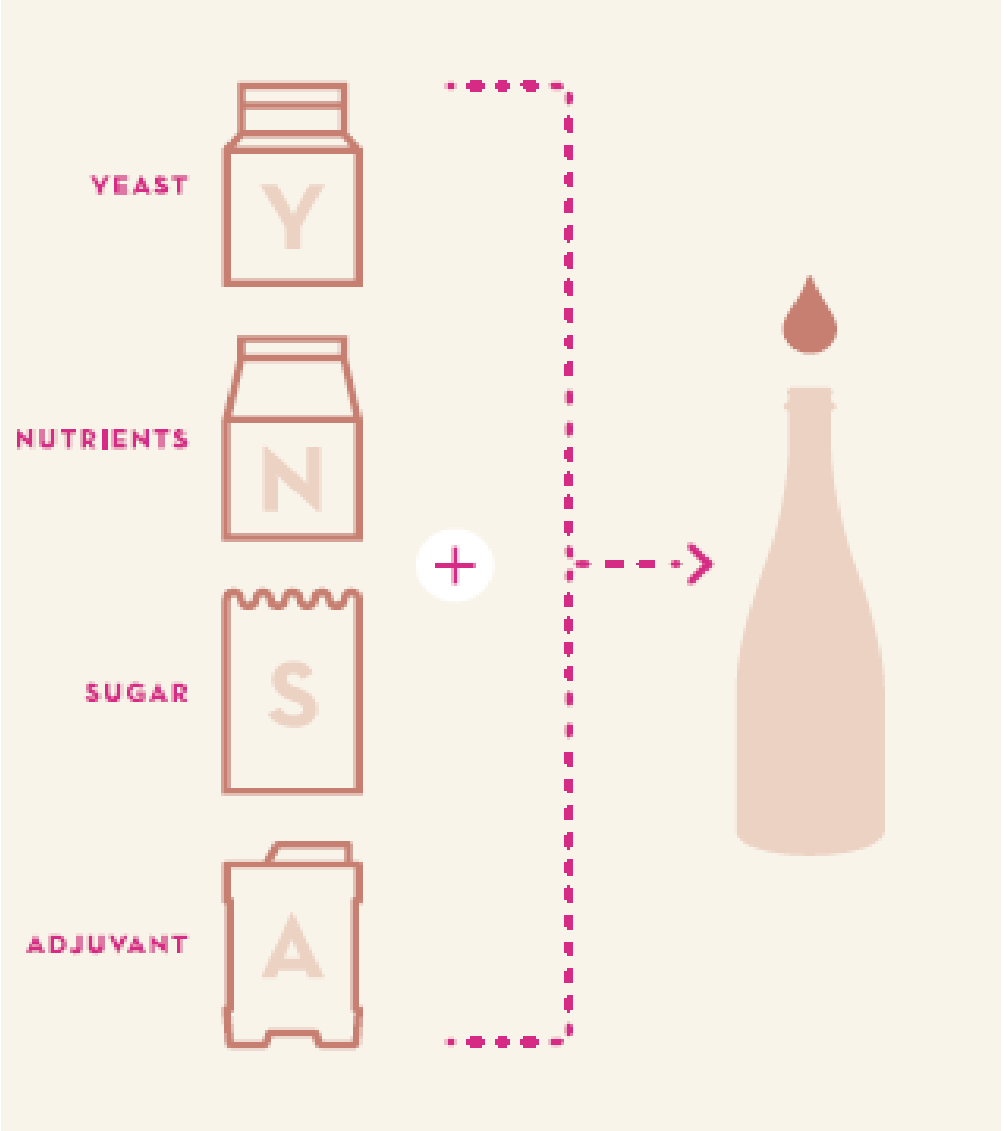
Traditional method – bottle fermentation

- Bottle fermentation is an elaborate process in which every single bottle becomes an individual fermentation tank, so to speak.
- Including the aging time at the winery before the wine is sold; this process requires a minimum of fifteen months and usually takes three years or more.
- Invariably, bottle-fermented sparkling wines are more expensive than tank fermented bubblies.

- classic or traditional method in Europe;
- in the United States, it's called the champagne method or méthode champenoise.

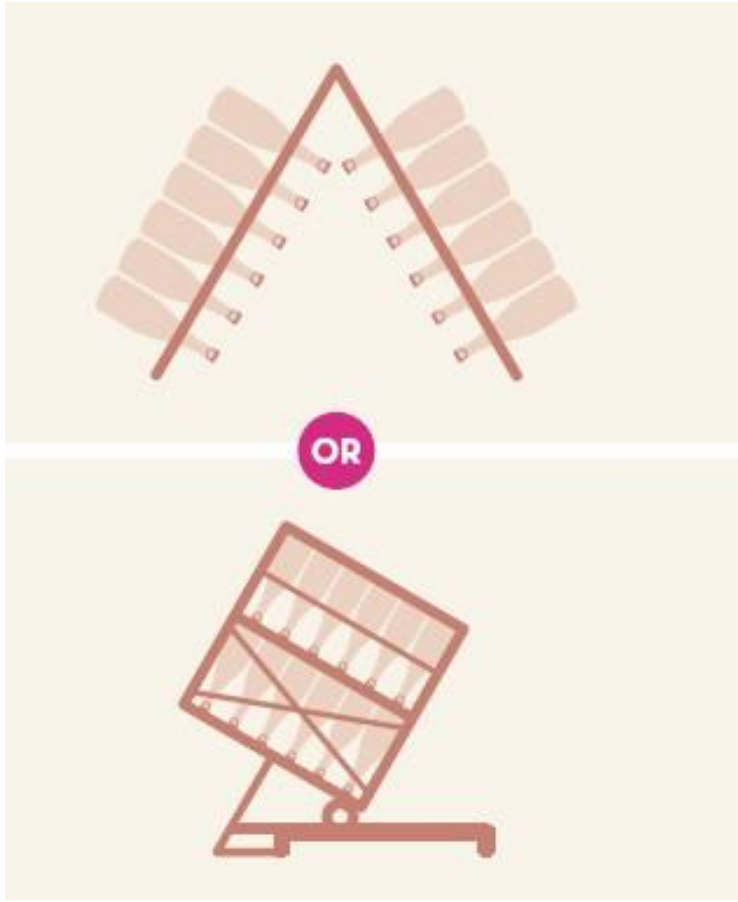
Tirage

- The tirage addition is a mixture of yeast, sugar, nutrients, and an adjuvant/riddling aid that is added to the base wine and kept in suspension by mixing, then added to each bottle for the secondary fermentation.
- The yeast create alcohol, and more importantly, CO_2 gas, necessary for creating bubbles and pressure in the bottle.



Riddling

- Riddling is the act of gradually tipping and shifting the bottles on point over a period of time to slowly move the lees down into the neck of the bottle.
- Riddling can be done manually by hand or mechanically with a gyropalette.
- Riddling is initiated after the secondary fermentation is complete and usually takes several weeks.



Disgorgement

- The bottle necks are passed through a freezing liquid to freeze the yeast to the seal at the top of the bottle, the yeast is removed with the cap.

DOSAGE

- The dosage (dosage liqueur) is the winemaker's final opportunity to add a unique touch to the wine.
- The dosage may include a mixture of sugars, wines, distilled spirits, etc. It is the special recipe that helps define many wines.
- It also helps determine the sugar level in the finished wine which relates to the dosage classification.
- The dosage solution should be final filtered before addition to the bottles.

Transfer Method: **The transfer method is similar to the traditional method, until the disgorgement step. The wine is disgorged into a tank after the second fermentation, filtered, then rebottled in new bottles.**

Tank Method (Charmat): **In the tank method, the second fermentation takes place in a sealed tank rather than in bottles. This is a less expensive method, but also produces less bubbles in the final wine.**

Injection: **With injection, the cheapest method, bulk wine is simply injected with carbon dioxide, similar to soft drinks. Injection is banned in the European Union.**

Tank fermentation

- The quickest, most efficient way of making a sparkling wine involves conducting the second fermentation in large, closed, pressurized tanks.
- This method is called the bulk method, tank method, cuve close (meaning closed tank in French), or charmat method (after a Frenchman named Eugene Charmat, who championed this process).
- Sparkling wines made in the charmat (pronounced shar mah) method are usually the least expensive. That's because they're usually made in large quantities and they're ready for sale soon after harvest. The whole process can take just a few weeks.
- Also, the grapes used in making sparkling wine by the charmat method (Chenin Blanc, for example) are usually far less expensive than the Pinot Noir and Chardonnay typically used in the traditional or champagne method.

Did you know?

65 km/h (6 atmosfera)

40 km/h (2,5 amtosfera)

49,000.000 bubbles (American Bill Lembeck: measured volume of bubbles)

250,000.000 bubbles (Franch Bruno Duteurtre recorded bubbles, compjuter calculated)

Champagne and Its Magic Wines

✓*Non-vintage Champagne*

- Non-vintage (NV) Champagne — any Champagne *without a vintage year on the label* — accounts for 85 percent of all Champagne.
- Its typical blend is two-thirds black grapes (Pinot Noir and Pinot Meunier) and one-third white (Chardonnay). Wine from three or more harvests usually goes into the blend. And remember, the wines from 30 or 40 different villages (or more) from each year can also be part of the blend. The Champagne winemaker is by necessity a master blender.
- Non-vintage Champagnes will be left to mature for at least 1.5 years

Champagne And Its Magic Wines

✓*Vintage Champagne*

- The best grapes from the choicest vineyards are put into Vintage Champagne (this is especially so for prestige cuvées).
- Usually, only the two finest varieties (*Pinot Noir and Chardonnay*) are used in Vintage Champagne. Pinot Meunier is saved mainly for non-vintage Champagne.
- Most Champagne houses age Vintage Champagnes at least two years more than their non-vintage wines. The extra aging assures more complexity.
- The grapes all come from a year that's above average, at least — or superb, at best.

Vintage:

- only from good seasons
- every vintage is different

Non vintage

- it is corrected using reserve wine
- always simillar

Champagne and Its Magic Wines

✓*Blanc de blancs and blanc de noirs:*

- **A small number of Champagnes derive only from Chardonnay; that type of Champagne is called blanc de blancs—literally, "white (wine) from white (grapes)."** A blanc de blancs can be a Vintage Champagne or a non-vintage. It usually costs a few dollars more than other Champagnes in its category. Because they are generally lighter and more delicate than other Champagnes, blanc de blancs make ideal apéritifs.
- **Blanc de noirs Champagne (made entirely from black grapes, often just Pinot Noir) is rare but does exist.** Bollinger's Blanc de Noirs Vieilles Vignes Francaises ("old vines") is absolutely the best, but it is very expensive ($400 to$450) and hard to find.

Champagne and Its Magic Wines

- ***Rosé Champagne***

- Rosé Champagnes—pink Champagnes—can also be vintage or non-vintage. Usually, Pinot Noir and Chardonnay are the only grapes used, in proportions that vary from one house to the next.
- Winemakers create a rosé Champagne usually by including some red Pinot Noir wine in the blend for the base wine. A few actually vinify some of their red grapes into pink wines, the way that you would make a rosé still wine, and use that as the base wine. Colors vary quite a lot, from pale onion-skin to salmon to rosy pink. (The lighter-colored ones are usually dryer.) Rosés are fuller and rounder than other Champagnes and are best enjoyed with dinner.

Champagne

- This is the most popular of the sparkling wine worldwide. It is produced in the champagne region in France, though some sparkling wines in America and England are branded as champagne (with a small ‘c’).
- Three types of grapes of grapes – Pinot Noir, Chardonnay and Pinot Meunier- are blend together through the method Champenoise to create the amazing taste and smell associated with Champagne.
- Dom Pérignon is probably the most well-known brand of Champagne.

Crémant

- Produced mostly in France, this type of sparkling wine is mostly known for its low amounts of carbon dioxide.
- Traditionally, carbon dioxide pressures were used for the crémant hence giving it a creamy mouth feel.
- sparkling wines made outside of Champagne using the Champagne method of secondary fermentation in bottle.

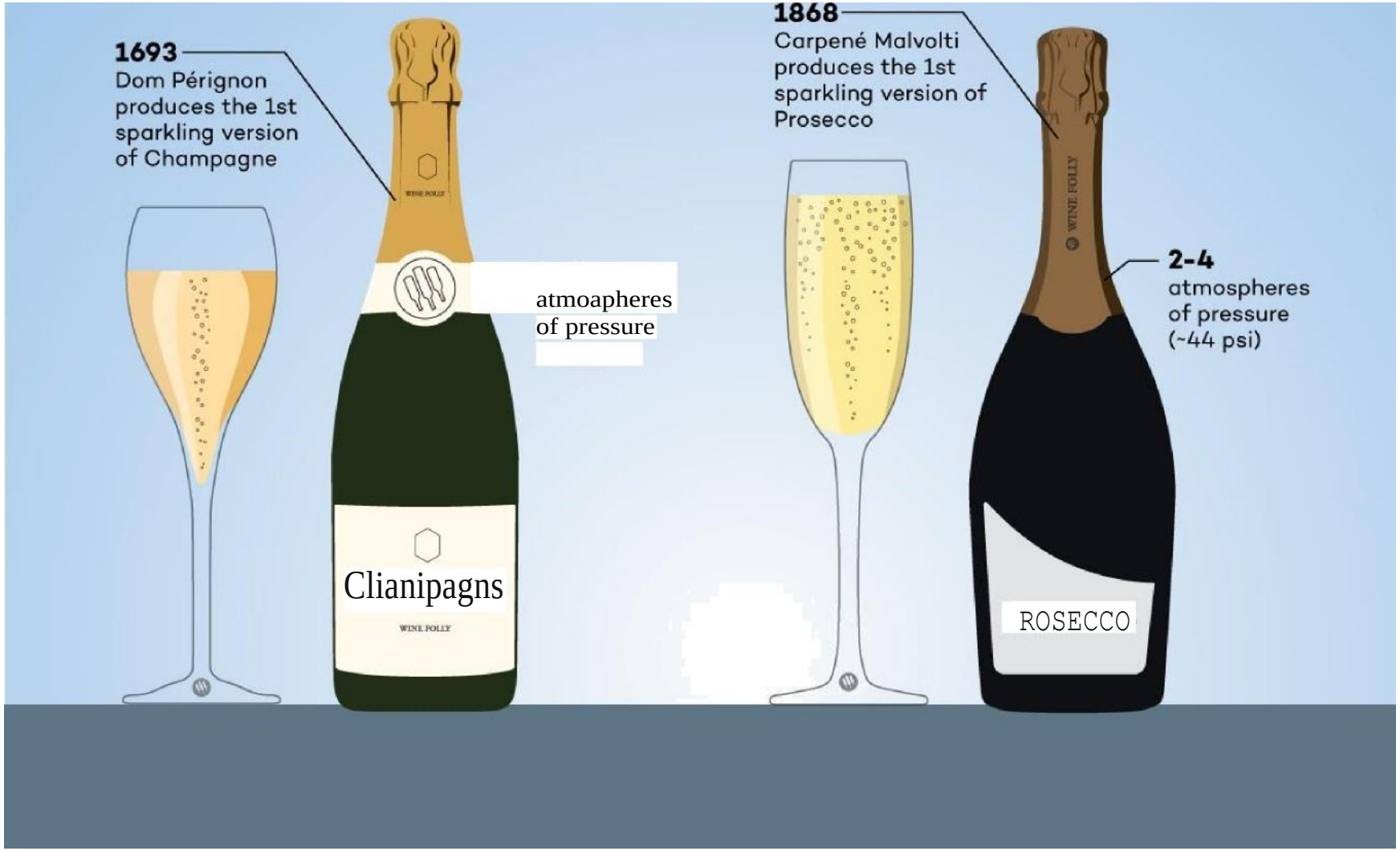
Cava

- This is a Spanish (white or pink) sparkling wine that uses the champenoise method but with different types of grapes from those used in Champagne.
- Macabeo, Parellada, Xarello, and Chardonnay grapes are used.
- There are many cava sparkling wines varieties depending on the level of dryness.

Prosecco

- This is an Italian sparkler that is produced through the Charmat method, it is dryer and sweeter due to the prosecco grapes used.
- It comes in lightly sparkling and fully sparkling versions.

Champagne vs Prosecco



VAL –BRUT (max 12 g/L)

VAL–SUVI (17-32 g/l)

VAL ROZE–extra suvi (12-17 g/l)