Cultivation of table grapes

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Plant

The grapevine is a climbing plant, some varieties of which bear juicy edible berries. It will hold naturally to any type of support (tree, wall, wire, etc.). It has been grown for 4000 to 5000 years in many countries with temperate, Mediterranean or even tropical climates.

Origin

The cultivated grapevine belongs to the genus *Vitis*, that probably originated in Pangea and more precisely in Laurasia, a continental area corresponding to Europe, North America and Asia, excluding India (Branas, 1974). In those distant days, there were already species adapted to different climates—from the coldest to the hottest. This specialisation is still seen today, well after the differentiation of the continents during the Tertiary era.

Grapes are eaten fresh, dried or processed to make wine or other alcoholic drinks. The most commonly used varieties are derived from the species *Vitis vinifera*, which originated in Europe, while rootstocks suited to biotic and abiotic conditions tend to be American vines (*Vitis riparia, rupestris, berlandieri*, etc.).

Climate required

The ideal areas for growing grapevines have climates ranging from temperate to Mediterranean. They thus have a marked winter that is not too cold, a sunny summer that favours ripening and rainfall occurring mainly in winter.

This being so, vines are grown in both hemispheres with the limits imposed by too low a temperature that can freeze the vines in winter and prevent satisfactory ripening in summer. Conversely, climates without a winter raise other physiological problems such as defects in bud burst or juice composition that is unfavourable for fruit quality. However, this problem is less serious for table grapes than for wine grapes as wine making requires a good balance between sugar, acids, tannin, etc. to produce quality wines. The use of certain cultural practices such as pruning twice a year has made it possible to extend table grape production to tropical climates with satisfactory results.

In addition to temperature, rainfall is clearly very important in the suitability of a region for grape production. Water requirements are not very large, being some 600 to 700 mm per year in a Mediterranean climate. Shortage of water can sometimes be compensated by irrigation, but excessive precipitation that enhances the development of fungal diseases and is unfavourable for ripening is more difficult to manage.

Soil

Roots may be more than 6 metres long but usually measure less than 3 metres. Occupation of the soil depends on the physical and chemical characteristics of the latter. Root growth depends on soil depth, type (clay, limestone, etc.) and the proportions of fine soil and pebbles. Soil temperature strongly affects the rate of root growth; this increases from 10° to 30°C but is nil outside these limits. Insufficient soil moisture can cause problems (vine apoplexy, dryness), as can excessive moisture (asphyxia). The presence of lime often results in high quality fruits but too much ‘active’ lime hinders the use of many rootstocks.

Soil is rarely a limiting factor. Poor soil enhances quality and rich, deep soil is more favourable for quantity. In fact, the grapevine is a fairly tolerant plant, growing on both alkaline soils (limestone soils with a pH of up to 8.5) and acidic soils (to pH 5.5). However, very acidic soils with a pH of less than 4 can cause boron and magnesium deficiency. The soil must be limed in this case.
The growth cycle

The growth cycle of the grapevine has several stages shown below (diagram by Branas). D = bud burst, F = flowering, T = stopping of shoot growth, V = ripeness, Ch = leaf drop.

Depending on the zone, this cycle can run for a full year or just for six months. In this case, the plant is managed with a succession of ‘active lives’ separated by only three weeks between pruning and bud burst. Under these conditions, the plant obviously ages more quickly and vines must be replanted more frequently than in a temperate climate.

Setting problems

Bunches may contain several types of berry. Small green berries are non-pollinated ovaries that remain as they are until the harvest. Parthenocarpic berries are truly seedless, having formed and ripened after pollination not followed by fertilisation. Grapes displaying stenocarpy contain soft, aborted seeds. Finally, seeded grapes contain at least one seed resulting from pollination followed by fertilisation.

The seedless feature is permanent in Zante grapes (Corinth grapes) and accidental in other varieties. This then causes millerandage, or ‘hen and chickens’, a defect that strongly affects the value of table grapes and even prevents them from being grown as in the case of ‘Dattier’ in France.

Parthenocarpy can become an asset when it is a varietal feature as the bunches consist entirely of seedless grapes. This character is increasingly sought-after, examples being ‘Sultanine’, ‘Perlette’, ‘Dattier de Beyrouth’, ‘Delhiro’, etc.

Pruning

Unpruned vines remain as lianas, form bushes or creep across the ground. As soon as the tendrils become entwined around any kind of support, the plant climbs and spreads its leaves in the sun to absorb as much energy as possible. In this case, there may be a lot of small, acid grapes that are not very sweet and the vines gain exaggerated length year after year.

Vines are pruned for the following reasons:
• managing the number of fruitful buds and hence the future harvest;
• controlling the spatial distribution of future shoots to enhance photosynthesis;
• adapting to the cultural techniques planned, such as mechanisation, weeding, etc.;
• preparing for subsequent pruning operations and ensure the future of the vineyard.

There are a great number of pruning systems and it is impossible to describe them all in detail. Most are either in the short or long pruning category.

Short pruning consists of leaving a number of renewal spurs with two eyes on one or more arms. This is done in bush pruning and in Royat cordon pruning. The system is suitable for varieties with fertile lower eyes such as ‘Alphonse Lavallée’, ‘Cardinal’, ‘Muscat de Hambourg’, ‘Datal’, ‘Chasselas’, etc.

The principle of long pruning is based on the need to keep mid-position eyes on a cane to ensure a satisfactory crop on varieties whose lower eyes bear little or no fruit. One or two long bearing units (with 6 to 8 eyes) bear the crop while one or two renewal spurs (with two eyes) will provide the rod and the renewal spur for the next pruning operation. Single Guyot is the most common of these pruning systems, with double Guyot reserved for very vigorous vines and rarely suitable for high-quality harvests. Long pruning is necessary for varieties such as ‘Danlas’, ‘Italia’, ‘Perlette’, ‘Dattier de Beyrouth’, ‘Delhiro’, etc.
Tying

The imagination of vine growers seems unlimited as vines can be seen growing freestanding—bush pruned or simply spreading across stony ground—or, in the other extreme, growing on very complicated trellising systems such as those in South Africa that resemble factory roofs, by way of bamboo pergolas. In fact, the decision to use a particular method is often governed by the behaviour of the grape variety in its environment and by the materials available.

Vine management

Bud removal is performed a few days after bud burst and water shoots are removed a month later after growth of about 15 cm. Both of these operations are aimed at removing shoots considered as useless for the formation of the pruning system, shoots that are too weak or are sterile. They allow stronger growth of the remaining canes, reduce the risk of disease and result in fewer pruning wounds. Care is also taken to remove any shoots that grow from the rootstock. The shoots are topped, making the passage of machines easier (especially sprayers), improving berry setting and reducing the risk of damage by wind. Apart from the production aspect of these operations, a trellised, well-topped vineyard is an attractive sight. Deleafing can be performed at the bases of the shoots to give the bunches better exposure to sunlight and reduce the risk of grey rot (Botrytis cinerea).

Fertilisation

As for many perennial crops, distinction is made between two practices—basal dressing and annual maintenance dressing. Basal dressing and amendments are placed before planting to correct any weak points revealed by soil analyses. Soil reserves are improved at the same time, enhancing growth of the young plants. Annual maintenance dressing theoretically makes it possible to compensate for the exporting of various elements, that is to say plant consumption to produce wood, leaves and grapes. It is considered that the equivalent of 70 kg nitrogen and 90 kg potassium should be returned to the soil to compensate for the production of 10 tonnes of grapes.

Irrigation

While the watering of wine grapes is forbidden in France, it is used and is even essential in some hot zones where table grapes are grown. It is impossible to determine the water requirements of a vineyard schematically as they depend strongly on soil characteristics, climate and, of course, the rootstock and the grape variety. A modern method consists of continuous monitoring of soil moisture using tensiometers set at different depths and then irrigation when the readings show that the soil is beginning to dry. This both saves water and dispenses the right amount for the satisfactory growth of the plants. Irrigation techniques are varied and depend on both cultural and economic factors. The only rule to be respected is that of avoiding the use of sprinkler irrigation as this wets the foliage and enhances the spread of fungal diseases. It is therefore natural to use microsprinkling or trickle irrigation. The latter technique also requires the least water.

Protection against fruit-eating birds

Grapes are targeted by birds in some production areas, especially from veraison onwards (when the berries
The growth cycle and the main cultural techniques

CLOSE-UP

change colour). Damage may be limited to pecking or the whole bunch may be eaten. The harvest is destroyed in both cases. The vineyard must therefore be protected either by a bird scaring system or, in some severe cases, by full netting.

Harvesting

The first harvest is three years after planting in temperate areas but this can be reduced to half in the tropics where twice-yearly pruning is used. In contrast with wine grapes, the harvest is carried out entirely by hand. The bunch stem is cut with a pruning knife or secateurs and fruits are then placed in trays in shallow layers to prevent bruising. The bunches may be trimmed to remove deformed or damaged berries to attain optimal visual quality.

Rootstocks and grafting

Before phylloxera appeared in 1868, vines were propagated by cuttings or by layering. It has since become essential to graft on to resistant American rootstocks. The rootstock is chosen according to its suitability to the soil (resistance to lime and tolerance of drought or moisture), its resistance to biological pests (phylloxera and nematodes), compatibility with the grape variety and the ability to give scions the vigour matching the yield level sought.

The following are among the most widely used rootstocks:

- S04 and 5BB (V. riparia x V. berlandieri), resistant to active lime and very productive;
- 3309C (V. riparia x V. rupestris), sensitive to drought, calcifugous;
- 41B (Chasselas’ x V. berlandieri), very resistant to chlorosis but not perfectly resistant to phylloxera;
- Fercal (V. berlandieri x ‘Colombard No. 1’) x 333 EM, currently the most resistant to lime.

There are many grafting methods but they can be classified in the three following categories:

- cleft grafting and derivatives used for field or bench grafting;
- shield budding used for green budding (in central Europe);
- the whip and tongue graft and the Omega graft are the techniques most commonly used in bench grafting.

Once the graft has been performed (now using machines), it is covered with wax and stratified in moist peat in wooden callusing boxes for 15 to 20 days under warm conditions in the dark. This allows the formation of a callus at the graft before planting in the nursery.