

## Viticulture of Hungary

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### Summary

For several thousand years, vine has been grown in the Carpathian basin, where the climatic and soil conditions are favourable for viticulture. During this long period, vine growing has been developing until it reached its current niveau. We grow propagation material, table grape and wine grape. The produced wine grape varieties are grown on the largest area, of which 72% is white wine and 25% is red wine. Only 3% remains for table grapes. The surface of vineyards is about 63 000 ha, which can be found in 22 wine regions. The biodiversity of vine is very rich in our country. There are a lot of native and valuable bred varieties and clones in cultivation. The resistant and winter frost resistant vine varieties have an important role in our continental climate. The in 75% of the vineyards is on hills and mountains, 25% of them is on the Great Hungarian Plain. High cordon with cane pruning dominates the training and pruning system.

Unfortunately, vine stocks suffer from a lot of diseases and by using pesticides we pollute the nature.

Viticulturists in Hungary produce excellent raw material and provide oenologists with them who make wine of excellent quality.

**Keywords:** viticulture, vine varieties, soils, climatic conditions, wine regions, training and pruning systems, diseases, propagation material

### Historical survey

Vine and its delicious yield has been known in the basin surrounded by the mountains of Middle–Europe since thousands of years, to which paleontological findings (seeds, leaves) give evidence. The oldest seed findings from the Celtic times were found by experts in Sopron. Later, but still before the Hungarian conquest, King Attila carried with his army the Hun vine variety 'Weisser Heunish' to the whole Europe. It is an interesting fact because this vine variety is the ancestor of more world wine varieties (Chardonnay, Cabernet sauvignon Gamay, Furmint, etc.) The genetics has proved this in case of 76 varieties up to now.

In era of the Roman Empire, Emperor Probus with his army planted the first vineyard in the wine region called Vojvodina (Serbia today). The Roman people extended viticulture to the territory of Pannonia as far as

Danube's line. In the Middle Ages, the wines from Syrmia, the Great Hungarian Plain, Ménes (Arad Mountains) and Tokai wines appeared in Hungarian royal courts, too. In the era of the Ottoman occupation, lasted for 150 years, the Turkish people hampered viticulture with varieties of taxes. After this era, at the end of 1700s queen Maria Theresa settled people from Germany (Danube Swabians) to the areas emptied by the Turkish. Working diligently, the German people were familiar with viticulture very well and they established orderly vine gardens with new cellars, and built cellar-villages for example in Hajós, in Györköny, in Villány ect. Fortunately, these cellars have remained and are still guard the vine and wine culture of the Germans. At the end of the XIX. century, (beginning from 1875) a big tragedy hit the Hungarian wine regions. An insect called phylloxera was brought into Europe from North-America, it spread unbelievable fast and destroyed the Hungarian vineyards. Two strategies were applied in the battle against phylloxeras (Lónyai, 1896; Feyér, 1970). One of them was planting vine to sandy soil being immune from these insects. Vine occupied larger and larger such areas on the Great Hungarian Plain. The other way against phylloxera was the applying rootstocks, that is, making and planting graftings on heavy soils. Both methods brought upturn of viticulture in the wine regions which survived this tragedy. Due to the reorganization of the agriculture in Hungary, more and more private farms were closed and were replaced with agricultural large-scales (co-operatives, state-owned farms).

Mechanical cultivation replaced handwork, the high training system replaced the low one and the stocks were planted in wide lines and on big growing areas. The traditional covering was not used anymore. This way the vine stock varieties like Furmint, Kadarka, Mézes Fehér vine), being exposed to adverse weather conditions (frosts, sun ray), could not survive, therefore these squeezed out from the large-scales. The composition of the varieties has changed for advantage of world varieties.

95% of the vine is processed for wine, of which 75% is white wine and 25% is rosé and red wine. The proportion of table grape is insignificant, it is rather grown in home gardens or to be sold on the market.

The socialist era has fallen and from 1989 the large-scales were privatized and the viticulture and enology sector took different forms of private ownership. The planting of new and modern plantations began, and modern wine cellars spread like mushrooms. Most of our viticulture and enology work has reached the European niveau for today. We provide the market with more and more delicious wines that won international wine competitions. The area of vine growing, having survived a lot of tragedies, reduced drastically. Before Trianon, we had

near 250 000 ha vineyards in Hungary, but today there is only 65 000 ha of it.

#### *Cultivated vine varieties*

The security of viticulture and the quality of end-product is determined by the gene type, that is, the variety of the vine. In this sense, variety is a fundamental means of our viticulture. Thanks to a lot of varieties, vine biodiversity is very rich in the Carpathian Basin in Hungary. Our palette of varieties originates from ancient varieties of wine-growing areas and from the world's vine varieties and bred hybrids. Cultivated vine varieties form three groups: rootstocks, table-grape varieties and wine varieties. The diversity of the varieties determines that of our wines, too.

The cultivated rootstocks were bred by Zsigmond Teleki from American wild vine in Villány at the end of XIX. century. His rootstocks: T 5C, T-K 5BB, T-K 125 AA, and S.O.4 gained world-wide success. They are cultivated as grafting in large areas in most viticultural countries (Csepregi and Zilai, 1989).

The work of John Mathias brought dramatic change in breeding table grapes. Before that, Hungarians consumed wine grape varieties with bigger berries as fresh table grape (e.g. Kövérszőlő, Blauer Portugieser, Pamid, Arany Sárfehér). John Mathias as the first Hungarian grape breeder bred new hybrids table grapes with early ripened, big grapes and berries and muscat smell which were world-wide sensation at his time [Szőlőskertek királynéja mucat, Mathiász Jánosné muscat (John Mathias's Wife muscat)]. Other national and foreign researchers used his as gene source for breeding his hybrids. Nowadays, a lot of vine grape varieties are available for producers and consumers in our country. Varieties resistant to insects damaging table grape varieties (Fanny, Nero, Teréz, etc.) are in focus because they are suitable for environmental viticulture and for bio-products.

A wide range of vines can be found on the palette of the varieties. By adapting to the continental climate, frost resistant and easy-to-bred varieties took advantage while preserving the traditions of the respective vine region. The main varieties in Hungary are White wine: Furmint, Welschriesling, Bianca, Chardonnay, Cserszegi fűszeres, Rajna Riesling among white wines; and Cabernet Franc, Blaufränkisch, Blauer Portugieser, Merlot and Zweigelt among red wines (*Table 1*).

#### *Climate*

Continental climate with hot, dry summer and cold winter is dominant in the Carpathian Basin. Mainly the Atlantic, the Atlantic, the Oceanic and the Mediterranean climate and continental streams may influence our

climate. The average rainfall is 550 mm year<sup>-1</sup> and 300–350 mm in the vegetation period. The rainfall distribution is not favourable. The global climate change results in fewer rain during summer which may cause further difficulties in non-irrigated vineyards in Hungary. Sometimes in the vegetation period there is no rain during three months. The temperature in summer varies between 30 °C and 38 °C, sometimes it reaches 40–42 °C, while in winter it may be extremely low: it may vary between -21 °C and -30 °C. Late frost in May and early frost in October is not unusual either (Dunkel et al., 1980; Hajdu and Borbásné, 2009).

Table 1. *Grapewine varieties with the biggest surface (over 1000 ha) in Hungary*

| Name of variety    | Area in ha |
|--------------------|------------|
| White wines        |            |
| Aletta             | 1786       |
| Bianca             | 5006       |
| Chardonnay         | 2471       |
| Chasselas          | 1129       |
| Cserszegi fűszeres | 4323       |
| Furmint            | 3901       |
| Hárslevelű         | 1638       |
| Irsai Olivér       | 1724       |
| Riesling italico   | 4004       |
| Muscut ottonel     | 1303       |
| White riesling     | 1297       |
| Müller-Thurgau     | 1681       |
| Pinot gris         | 1691       |
| Zalagyöngye        | 1014       |
| Green veltliner    | 1435       |
| Red wines          |            |
| Cabernet franc     | 1406       |
| Cabernet sauvignon | 2663       |
| Blaufränkisch      | 7488       |
| Merlot             | 2039       |
| Pinot noir         | 1127       |
| Zweigelt           | 1723       |

The effective heat sum: 3100–3400 °C. 150 active days are necessary for early ripening cultivars, and 180–200 days are necessary for the late ripening ones.

In terms of solar exposure, the global radiation varies between 4800–4900 MJ m<sup>-2</sup>. Sunshine hours reach 2000 hours. The photosynthetically active radiation goes between 400–700 nm.

Hot sunshine is dangerous in growing period (July and August) for the vine. The prevailing wind direction is North-West, in the Danube-

Tisza Interfluve the wind direction is North-East. The windiest season is early spring and early autumn.

#### *Hungary's historical wine regions*

The climate conditions and the role of soil surface relief are just a few of the inevitable impacts which may affect the quality of grapes and wines to a large extent. Grapevine is a plant which is able to utilize efficiently the nutrients originating from the surface soils, below-ground soil layers and even from the rocks of the parent materials. Grapevine has long and deep rooting system being able to collect the hardly utilizable water, as a result of which it is able to tolerate drought quite well. The wines prepared can reflect the quality of the soil and its composition which the vine originates from. There are different soil types in the Carpathian Basin which are suitable for viticulture. The most characteristic soil types include sandy soil and chernozem type (Kunsági wr.), loess soil (Szekszárd wr.), basalt stone (Badacsony wr., Somló wr.), lime and dolomite (Mór wr., Villány wr.), rhyolite tuff of the volcanic rocks (Eger wr.), rhyolite, andesite, dacite soil (Tokaj wr.), luvisols and cambisols (Balatonfüred-Csopak wr.) (Kozma, 1966).

The 22 wine regions occupy around 64 962 ha surface (Table 2). Modern vineyards were planted in the wine regions, which are favourable not only from the aspect of economy but they also have a beautiful landscape.

Growing wine is much about hand work. There is human resources for this in agriculture, in horticulture and in viticulture as well, however, a lot of work is done by machines in viticulture (e.g. tillage, pre-pruning, cane tying, topping, plant protection and harvest), still not we cannot rule out human resources. In particular at the green grafting, at the table grape production where the cluster thinning and shredding, removing of cluster tops and their harvest cannot be done without hand work or human resources.

#### *Table Grape Cultivation*

Hungary does not belong to table grape cultivating countries. Here the main continental climate is not favourable for their cultivation, mainly due to winter frosts. The buds of table grape varieties freeze below -15 °C.

But some are protected from frost: these are the southern slopes of hillsides 200 m height above the sea-level, where table grape cultivation can be successful because the fresh grape is marketable on Hungarian markets. Really delicious grapes are cultivated in Hungary. We also have a wide range of table grapes having big clusters and berries, ripe early, and being rich in taste, colour and shape. The Hungarian breeders bred a

lot of excellent resistant table grape varieties, such as Borostyán, Csépei muskotály, Esther, Fanny, Lidi, Nero, Pegazus, Pölöskei muskotály, Teréz, and can be produced without reduced amount of pesticides, and are capable of producing bio-products of them (Csepregi and Zilai 1989; Hajdu, 2013).

Table 2. *The surface of the Hungarian wine regions (HNT, 2018)*

| Number     | Name of the wine regions | Area in ha |
|------------|--------------------------|------------|
| 1.         | Badacsony                | 1402       |
| 2.         | Balatonboglár            | 3420       |
| 3.         | Balatonfelvidék          | 865        |
| 4.         | Balatonfüred-Csopak      | 2027       |
| 5.         | Bükk                     | 1019       |
| 6.         | Csongrád                 | 1080       |
| 7.         | Eger                     | 5609       |
| 8.         | Etyek-Buda               | 1587       |
| 9.         | Hajós-Baja               | 1855       |
| 10.        | Kunság                   | 20773      |
| 11.        | Mátra                    | 6401       |
| 12.        | Mór                      | 582        |
| 13.        | Nagy-Somló               | 564        |
| 14.        | Neszmély                 | 1081       |
| 15.        | Pannonhalma              | 639        |
| 16.        | Pécs                     | 676        |
| 17.        | Sopron                   | 1673       |
| 18.        | Szekszárd                | 2224       |
| 19.        | Tokaj                    | 5758       |
| 20.        | Tolna                    | 2422       |
| 21.        | Villány                  | 2464       |
| 22.        | Zala                     | 841        |
| Total area |                          | 64962      |

Wine grape plantations require high investment to be profitable. Beside supporting the plants with a special equipments, it is also necessary to establish sprinkle systems and frost resistant systems. In addition, table grape cultivation requires a lot of handwork, therefore it can be implemented only in family farms. The plantation itself demands great investment, but they have a high production value and provide high profits. It is worth working with them.

#### *Training systems and Pruning Methods*

The vine is a liana plant therefore it is important to grow along a special support equipment. The functions of this equipment include, for example, guided growing of stocks and holding the mass of the yields.

Regarding its structure, it should be built of wood, concrete or stainless-steel metal materials, and along static line of force. Besides the support, the professional stretch of the wires is also essential because

they hold the sprouts and the yield. The well-built support equipment ensures phytotechnology, the effective plant protection and the mechanical works (Csepregi, 1982).

Vine stocks of low cultivation system (head and bush training) with short or alternating sprout pruning can still be found at old vineyards.

Their growing space is small (0.6–1.0 m<sup>2</sup>). Between the stocks there are fruit trees here and there.

Medium height cordon (Guyot, Royat cordon) became widespread, where the short pruning is applied in general. The growing space is middle (1.2–1.6 m<sup>2</sup>).

High cordon (high cordon, GDC, single curtain, umbrella) is the most common cultivation method. According to this method, vine stocks are growing on large space (3.0–3.6 m<sup>2</sup>). Several pruning system is applied in this method, but the most common method is short and long bearing pruning, cane or short cane pruning.

#### *The Sanitary Condition of the Vineyards*

A vine yard to live for more decades is valuable only if its stocks are healthy, produces continuously year by year and gives a fix income.

When planting young stocks, certified grafts, and specially cultivated varieties are planted on the ones appropriate for the soil. The nurseries enhance to keep the good health condition of their mother gardens and basic vineyards. The propagating material is checked by the Hungarian National Food Chain Safety Office (NÉBIH) before registering them, which serves as a guarantee for planting pure-bred, healthy grafts, and leads to a long-life, high production-capacity cultivations.

A special state task of the Research Institute for Viticulture and Enology NAIK in Kecskemét is to make and to maintain pathogen, clone and plant disease free propagating material. This is the first step of propagation (Bisztray et al., 2011). The pathogen-free material is free from viroid, viruses, phytoplasma, bacteria, ESCA and Eutypa diseases.

The pathogen-free stock plants are made with 'in vitro' culture and the young plants will be taken under isolated tents under control. The researchers of the institute work hard in this field.

Unfortunately, a lot of people plant uncontrolled propagation material on their vineyards. Therefore, these plantations have short life, the cultivars are mixed and their yield is low.

At the end of XIX. century the phylloxera destroyed our vine plantations. Nowadays the phytoplasma, ESCA and Eutypa decimate the vine stocks. All of them are very dangerous for the security of crop production. At the end, to tell the truth, we have to plant only pathogen-free material.

*The Connection between Viticulture and Enology*

Forming successful and good relationship between viticulture and enology is fundamental. Viticulturists produce the basic material for the winemakers. The cellar men can make delicious wines only from grape of high quality. The vine-wine sector is conservative, therefore it needs to be continuously renovated because this is the demand of the consumers and the market. The most challenging task is to change the cultivars' approach. This is a slow, time-consuming and expensive process. The income is increasing in wine making. Therefore, this sector well has to be organized well, in which the winery processes the grape yield and make wine from it.

In this case the quality is guaranteed.

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