

- There are two root growth stages during a growing season. First stage occurs in spring and lasts till mid-July; second stage starts in September (and does not occur at all, if the weather is too dry). Roots grow lengthwise during the first stage; root branching starts later.
- Roughly 30 % of active roots grow within 0.3 m; 60 % of roots grow within 0.3-0.45 m and the rest grows even deeper. Development of a root system relies on spacing and size of the above-ground vines (the bigger the vine, the larger the root system).
- **Skeletal soils** have proper aeration and temperature properties for grapevine cultivation. Water system of the soil significantly varies. Air is heated quickly above the skeletal surface of a soil. Higher temperatures last throughout the night. Weeds are scarce and grow slowly. Grapevine management is however difficult. Skeletal soils have a good nutrient intake and are suitable for irrigation (high efficiency). This type of soil is among the high-quality soil types.

- **Gravel soils** differ from skeletal soils in the size of soil skeleton particles. They are formed by weathering of parent material right on the location, or they are sediments from rivers. Red wine varieties as well as other varieties such as Rhine Riesling benefit from gravel soils.
- **Sandy soils** may be suitable for grapevine cultivation if certain prerequisites are accomplished. It is important to supply fertilizers in small doses and frequently. Ration among potassium, magnesium and calcium is important. In contrast to magnesium and calcium, potassium is absorbed quickly. Irrigation is very efficient. Red wine varieties are better for sandy soils (Limberger, St. Laurent, Zweigeltrebe, Pinot Noir, Portugal) and acquire high quality. White wine varieties (Sauvignon, Frühroter Veltliner, Pinot Gris). Suitable rootstock: K 1, Craciunel 2, 5 C or 5 BB.

- Table grape varieties flourish on sandy soils (they ripe early and rot only little). Plant only vigorous varieties.
- **Loamy and clay soils** are referred to as quantitative soil types. They have a good water retention and poor drainage; they aerate poorly and heat up slowly. Main challenge for loamy and clay soils is to plough adequate amounts of minerals into deep soil horizons and maintain a beneficial soil structure (layers beneath topsoil often become tight and compact). Very productive varieties flourish on loamy soils. Their high productiveness is enhanced with even water intake and even soil moisture. Aromatic varieties acquire intensive aromas. Irrigation is problematic.
- Grapevine does not tolerate water-logged and poorly aerated soils. Water table is a decisive aspect of cultivation and relies on a soil type; water table in well aerated soils equals ca. 2 m; in loamy soils ca. 3m.

- **Soil colour** may be a significant vineyard site agent. Regions with lots of light reception: Plant white wine varieties in light-colour soils and red wine varieties in dark-colour soils. Grapes of white wine varieties heat up more slowly than grapes of red wine varieties. White wine varieties heat up more on light soils as the sunlight is reflected off the soil, which increases the grape quality. Red wine varieties are more prone to sun scald (more common on white soils). Red wine varieties heat up more easily and do not require lot of warm air; they may be cultivated on dark soil which absorbs more sunlight, heats up and releases the heat at night. Red grapes require warmer microclimate in general, night air is warmer above dark soils.
- An evaluation system helps assess vineyard sites. Sites are assigned 0-9 points, depending on site properties. Unsuitable soil properties – 0 points, properties are adequate – 1-3 p., good properties – 4-6 p., excellent properties 7-9 p.

Igneous rocks

- Soil in vineyards inherits many properties from igneous parent materials:
 - Acidic rocks (95-85 % silica)
 - Neutral rocks (50-65 % silica)
 - Alkaline rocks (35-50 % silica)
- Acidic and neutral rocks contain silica and feldspar, they are light and less dense.
- Alkaline rocks do not contain silica, and may contain certain alkaline plagioclase, pyroxenes, amphiboles, olivenite, and form dark, more dense soils.

Acidic igneous rocks

Granite

- Orthoclase and silica are main constituents of granite. Weathering rate is slow. Soils are light in colour, dry quickly and are hard to till when dry. Nutrients easily wash out from this type of soils due to lack of calcium.
- Granite-rich soils are common in the north-western Znojmo regions. Rhine Riesling and Green Veltliner acquire excellent quality. Dolni Kounice region: Varieties such as Limberger, St. Laurent, Portugal and Zweigeltrebe flourish on this type of soil. Pinot Gris and Frühroter Veltliner also flourish here.

Porphyry

- Porphyry has a similar composition as granite, it is more acidic; weathering forms skeletal soils; soils are deeper, loamy-sandy, red to reddish brown, and heat-retaining. Common in the northern Bohemia; good for Gewurztraminer and Rhine Riesling plantings.

Trachyte

- Trachyte is a neutral igneous rock, weathering rate is the highest of all other igneous rocks; part of deep soils with high nutrient content (Tokai region).

Diorite

- Diorite is a medium-alkaline plagioclase, it may be found together with granite; it weathers more easily than granite; soils with diorite have less potassium but more calcium. Washing out of nutrients is slower.

Basalt

- Basalt contains alkaline plagioclase and pyroxenes; basalt weathers slowly. Small particles separate in layers and form dark, structured, loamy, very fertile soils rich in phosphorus, with little potassium.
- Wines from this type of soils are aromatic, fully coloured, full-bodied, and highly extractive.
- Common in Ceske stredohori (Litomerice, Mostecko regions). Excellent for red wines and full-bodied white wines (Pinot Blanc, Pinot Gris).

Sedimentary and metamorphic rocks

Limestone

- Limestones are mostly sediments formed in ancient seas; weathering varies depending on the components. Soils may be light, permeable, and may dry quickly as well as they may be heavy, clay and moist. In general, soils are less productive, require high supplies of nutrients; vines are less vigorous. Certain varieties may suffer from chlorosis.
- Production of mild, less vigorous wines with very gentle aromas. Good for Chardonnay, Pinot Blanc, and Silvaner.

Slate

- Origin of slates differs; slates may be sedimentary or metamorphic. Weathering is usually rapid. Results in formation of loamy, sandy loamy soils; may have enough nutrients which are constantly released.

Topographic factors

- Elevation restricts cultivation of grapevine and depends on latitude. Increase in elevation by 100 m reduces grape sugar content by 1.0-1.5 °NM (the so-called Czecho-Slovak Normalised Must-Weight Scale, one degree in the NM scale stands for one kilogram of natural sugar in 100 litres of grape must), and at the same time raises acidity by 0.9 per mille. Rising elevation delays phenological stages of a growing cycle.
- Grapevine should be cultivated in the lowest regions of the Czech Rep. (no frost basins). Depending on landscape topography, vineyard sites are found at max. 250-300 m above sea level.
- Landscape topography refers to the slope of the sites and their aspect. These parameters influence light perception at the vineyard (as well as its microclimate).

Southern exposures

- - are the warmest; mostly skeletal soils, less humus, more erosion, high evaporation from soil; the driest, less vigorous vines and lower yields. Ripening starts earlier, wines may be of higher quality.

Western exposures

- - have more thick and moist soils than southern and eastern exposures. Productiveness is higher than in southern and eastern exposures. Risk of fungi infestation rises (vines dry (from dew) more slowly).

Eastern exposures

- - Medium grapevine growth and productiveness. Light reception starts right in the morning; low night temperatures quickly subside to high daily temperatures. High leaf damage due to spring frosts. Water forms intercellular ice crystals which are quickly evaporated by the morning sun, this dries up the leaves. Leaf tissues may die, if water loss is high.

Northern exposures

- - have 4.4 °C lower summer daily temperatures and 2.4 °C lower winter average temperature than southern exposures.

- Long slopes experience changes in soil properties and soil moisture. Bottom sections of a slope are usually moister, deeper and the soil is more fertile. Therefore, it is suitable for more productive varieties with late bud break which require lots of water and are more resistant to frosts. Medium sections of slopes are warm and good for late varieties. Top sections of slopes are dry and may be windy. These are good for early varieties with low requirements on soil moisture.

Anthropogenic factors

- Influence of humans is a decisive factor for grapevine cultivation. Our biological and technical interventions shape the whole growth and development of the grapevine. We must respect all principles of nature which influence grapevine growth and development.