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Effect of water status of the vine plant in the chemical composition of the grape

Water affects basic physiological functions such as photosynthesis and as a result the quantity and quality of production. Irrigation significantly increases photosynthesis, production and vigor of vine shoots depending on irrigation time, amount of water applied, environmental conditions and other cultivation techniques. However, the application of large amounts of water increases production, with serious effects on quality, mainly due to the reduction of anthocyanins in the rail crust and the sugar content Deep knowledge of the mechanisms that regulate the photosynthesis of the vine and its differentiation under conditions of different water availability from the soil is necessary to determine the correct irrigation tactics. Irrigation is based on the climatic conditions prevailing in an area, the soil type of the vineyard and the stage of plant growth.

The concentration of sugars in the grape depends on the growing conditions, production size and climatic conditions.

The main sugars of grape are glucose, fructose and in lower content sucrose. These come from the photosynthetic activity of the leaf, but can be directed to the grapes.

The results of previous research on the effect of irrigation on carbohydrate concentration are contradictory, sometimes positive and sometimes negative, and there are cases where their concentration is not affected (Irrigation increases grape production).

The total soluble solids can be reduced when the dilution set causes the growth of the grape in their concentration is faster than carbohydrate accumulation

The plant growth of irrigated vineyards is observed due increased leaf area and photosynthetic capacity and as a result we have the production of total soluble solids in shoots tissues.

Many researchers report that the relationship between carbohydrates and grape weight is linear regardless of the fact whether irrigation is applied or not. The water stress of the stem affects growth of the grape both through its role in the size of the grape as well and through its effect on competition with shoots for the attraction of photosynthesis products. Nevertheless, the optimal application time and suitable aqueous soil content for the start of irrigation is difficult to identify. But it is generally accepted that a mild water stress, during the period shortly before percussion but also during the process maturation of the grape didn’t significantly affect photosynthesis activity, while further improving the ratio must / solid residue.

The estimation of total sugars can be examined before the beginning of harvesting period using a refractometer that continuously monitoring sugars with discrete analyzer (DA).

Effect of water status of the plant in phenolic compounds

Phenolic compounds are by-products of sugar metabolism. They are synthesized through the path of sicicic acid. The key enzyme for the synthesis of phenolics of acids is phenylalanine lyase (PAL), which removes phenylalanine from protein synthesis and leads it to the synthesis of phenolic compounds.

Another biochemical pathway that starts from glycolysis, also leads to the formation of phenolic substances. The contribution of three molecules of acetyl-coenzyme A (Acetylo CoA) and CO2 result in three Monynyl-coenzyme molecules.

Both different paths lead to the composition of chalcone which is a precursor of flavonoid phenolic compounds. The predominant groups of phenolic compounds in grapes are:

1. Benzoic acids (primary catechins, gallic , acid, hydroxybenzoic acid) and cinnamic acids (coumaric, ferulic).
2. Flavanols (campferol, quercetin, myricetin).
3. Flavans-3-all (catechins) and their polymers (tannins)
4. Anthocyanidins (malvidine, delphinidine, petunidine, peonidine and cyanidine). The phenolic compounds in the grape are found in the peel and in the seeds, while for some varieties of colored flesh these can also be found in the flesh

The grape peel is particularly rich in flavanols and anthocyanins (in the case of red varieties), while flavan-3-all are distributed mainly in their seeds and to a lesser extent in the peel (skin). The concentration of phenolic compounds in the grape varies during growth development maturation depending on the intensity of solar radiation, temperature, abscisic acid concentration and cultivation practices. There is generally an increase in concentration of anthocyanins from the percussion onwards, which is proportional to the increase in the surface of the grape. There are many reports about how carbohydrate accumulation may be affected in the synthesis of anthocyanins, through their effect on osmotic potential of cells of the skin of the grape. Existing reports on the effect of water to the final content of total phenols in the grape are contradicted. Several scientists argue that early and late deficiency water help increase total phenols while each factor that after spraying causes its increase rail size is inhibitory to the growth of phenolic.

On the contrary, formation of phenolic compounds is correlated with the level of water-soluble carbohydrates during the growing season and the maturation of the grape.

Thus any factor that increases the photosynthetic capacity of the leaf surface, increases the supply of grapes with carbohydrates and therefore increases the content of phenolic compounds. Many researchers concluded that increased rates of anthocyanins in water stress conditions are a result of increased concentration due to the reduction of the size of the grape, regardless of the biosynthesis rate of anthocyanins. According to them mild irrigation conditions during maturation enhance the content of phenolic compounds in the and in particular flavonols and proanthocyanides.

Classical methods are used to measure total phenolic content, total flavonoid content,
The most common are 1,1-diphenyl-2-picrylhydrazyl (DPPH) and ferric reducing
antioxidant power (FRAP).

However, it is well known that in the mesocarp (flesh) of the grape apart from water, sugars, proteins and minerals it contains a large amount of fruit acids. Next to sugars, organic acids are the most known compounds in grapes. They are very important components of the pericarp of the grape. There are many organic acids in the grape skin and flesh (including amino acids) but malic and tartaric acid account for over 90% of the total acids. Other organic acids such as succinic, acetic, citric, lactic, fumaric, and shikimic acids. The determination of acidity is expressed as titratable acidity (TA). The TA is an important parameter that producers of vine use to estimate the quality of wine.

Also measurement of acidity can be determined by ion chromatography (IC).