

READ THE TEXT AND WRITE THE QUESTIONS IN ORDER

IRRIGATION IN VITICULTURE

Irrigation in viticulture is the process of applying extra water in the cultivation of grapevines. It is considered both controversial and essential to wine production. In the physiology of the grapevine, the amount of available water affects photosynthesis and hence growth, as well as the development of grape berries. While climate and humidity play important roles, a typical grape vine needs 25-35 inches (635-890 millimeters) of water a year, occurring during the spring and summer months of the growing season, to avoid stress. A vine that does not receive the necessary amount of water will have its growth altered in a number of ways; some effects of water stress (particularly, smaller berry size and somewhat higher sugar content) are considered desirable by wine grape growers.

In very dry climates that receive little rainfall, irrigation is considered essential to any viticultural prospects. Many New World wine regions such as Australia and California regularly practice irrigation in areas that couldn't otherwise support viticulture. Advances and research in these wine regions (as well as some Old World wine regions such as Israel), have shown that potential wine quality could increase in areas where irrigation is kept to a minimum and managed. The main principle behind this is controlled water stress, where the vine receives sufficient water during the budding and flowering period, but irrigation is then scaled back during the ripening period so that the vine develops more the grape clusters instead of excess foliage. Sufficient water can be provided for the plant so that the balance between water stress and development is kept to optimal levels.

- 1) DOES- HOW- AFFECT-WATER- THE- PLANT?**
- 2) ESSENTIAL- IS- WHERE-IRRIGATION?**
- 3) SHOULD- WHEN –THE PLANT- MORE- RECEIVE- IRRIGATION?**

History

Advances in irrigation have allowed viticulture to flourish in very dry climates, such as parts of Australia, that might not otherwise be able to sustain grapevines.

The practice of irrigation has a long history in wine production. Archaeologists describe it as one of the oldest practices in viticulture, with irrigation canals discovered near vineyard sites in Armenia and Egypt dating back more than 2600 years. Irrigation was already widely practiced for other agricultural crops since around 5000 BC.

In the 20th century, the expanding wine industries of California, Australia and Israel were greatly enhanced by advances in irrigation. With the development of more cost efficient and less labor-intensive ways of watering the vines, vast tracts of very sunny but dry lands were able to be converted into wine-growing regions. The ability to control the precise amount of water each vine received, allowed producers in these New World wine regions to develop styles of wines that could be fairly consistent each year regardless of normal vintage variation.

- 1) CANALS- HOW- ARE- OLD- THE- IRRIGATION- FIRST?**
- 2) EXPANDED- WHEN- WINE- DID- INDUSTRIES- THE?**
- 3) REGIONS- WHAT- NEW WORLD- ARE- THE?**

Role of water in viticulture

Water is vital to many of the physiological processes of the grape vine, including photosynthesis. The presence of water is essential for the survival of all plant life. In a grapevine, water acts as a universal solvent for many of the nutrients and minerals needed to carry out important physiological functions, and the vine receives these by absorbing the nutrient-containing water from the soil. In the absence of sufficient water in the soil, the root system of the vine may have difficulties absorbing these nutrients. Within the structure of the plant itself, water acts as a transport to bring these nutrients to all ends of the plant. During the process of photosynthesis, water molecules combine with carbon derived from carbon dioxide to form glucose, which is the primary energy source of the vine, as well as oxygen as a by-product.

- 1) WHY- WATER- IS- FOR- VITAL- PLANT- THE?**
- 2) PLANT- HOW- WORK- DOES- WATER- THE- IN?**
- 3) SOIL- WHAT- ABSORBS- FROM-WATER-THE?**

Impact of different climate types

Viticulture is most commonly found in Mediterranean, continental and maritime climates with each unique climate providing its own challenges in providing sufficient water at critical times during the growing season. In Mediterranean climates irrigation is usually needed during the very dry periods of the summer ripening stages where drought can be a persistent threat. The level of humidity in a particular macroclimate will dictate exactly how much irrigation is needed with high levels of evapotranspiration more commonly occurring in Mediterranean climates that have low levels of humidity such as part of Chile and the Cape Province of South Africa. In these low humidity regions, primary irrigation may be needed, but in many Mediterranean climates the irrigation is usually supplemental. The amount of precipitation that occurs during spring and summer months is also important.

Continental climates are usually seen in areas further inland from the coastal influences of oceans and large bodies of water. The difference from the average mean temperature of its coldest and hottest months can be quite significant with moderate precipitation that usually occurs in the winter and early spring. Depending on the water retaining ability of the soil the grapevine may receive enough water during this period to last throughout the growing season with little if any irrigation needed. For soils with poor water retention, the dry summer months may require some supplemental irrigation. Examples of continental climates that use supplemental irrigation include the Columbia Valley of Washington State and the Mendoza wine region of Argentina.

Maritime climates tend to fall between Mediterranean and continental climates with a moderate climate that is tempered by the effects of a large body of water nearby. As with Mediterranean climates, the humidity of the particular macroclimate will play a significant role in determining how much irrigation is needed. In most cases irrigation, if it is used at all, will only be supplemental in years where drought may be an issue. Many maritime regions, such as Rias Baixas in Galicia, Bordeaux and the Willamette Valley in Oregon, suffer from the diametric problem of having too much rain during the growing season.

- 4) MEDITERRANEAN- WHEN- IRRIGATION- NEEDED-IS-CLIMATES- IN?**
- 5) WATER RETENTION- IS- IN- SOILS- WHAT- IMPORTANT- WITH – POOR?**
- 6) REGIONS-MARITIME-IS-WHAT-PROBLEM-THE-IN?**

Impact of different soil types

Sandy soils typically have poor water retention but good drainage. However, if its mixed with significant amounts of clay, such as this soil sample, its water retaining properties will increase while still draining well.

Soil can have a significant impact on the potential quality of wine. While geologist and viticulturist are not exactly sure what type of immutable or *terroir* based qualities that soil can impart on wine, there is near universal agreement that a soil's water retention and drainage abilities play a primary role. Water retention refers to the soil's ability to hold water. The term "field capacity" is used to describe the maximum amount of water that deeply moistened soil will retain after normal drainage. Drainage is the ability of water to move freely throughout the soil. The ideal circumstance is soil that can retain sufficient amount of water for the grapevine but drains well enough to where the soil doesn't become water-logged. Soil that doesn't retain water well encourages the vine to easily sleep into water stress while soil that doesn't drain well runs of the risk of water-logged roots being attacked by microbial agents that consume all the soil nutrients and end up starving the vine.¹

The depth, texture and composition of soils can influence its water retaining and draining ability. Soils containing large amounts of organic material tend to have the highest water retention abilities. These types of soils include deep loams, silty soils like what is typically found on the fertile valley floors such as in the California's Napa Valley. Clay particles have the potential to remain in colloidal suspension for long periods of time when it is dissolved in water. This gives clay-based soils the potential to retain significant amount of water such as the clay soils of the Right bank Bordeaux region of Pomerol. Many regions with these types of water retaining soils have little need for irrigation, or if they do it is usually supplemental during periods of drought. Soils with poor water retention include sand and alluvial gravel based soils such as those found in the Barolo and Barbaresco zones of Italy or in many areas of South Australia. Depending on the climate and amount of natural rainfall, areas with poor water retention may need irrigation.

Just as having too little water is detrimental to the grapevine, so too is having too much. When vines become water-logged they become a target for various microbial agents such as bacteria and fungi that compete with the vine for nutrients in the soil.

7) WHY- VITAL-SOIL-IS-FOR-THE- VINE- THE?

8) WHY- SOILS- RISKY-ARE-WATER LOGGED?

9) NEEDED-WHERE-IRRIGATION-SPECIALY-IS?

Irrigation systems

There are several methods of irrigation that can be used in viticulture depending on the amount of control and water management desired. Historically, surface irrigation was the most common means using the gravity of a slope to release a flood of water across the vineyard. In the early history of the Chilean wine industry, flood irrigation was widely practiced in the vineyards using melted snow from the Andes Mountains channeled down to the valleys below. This method provided very little control and often had the adverse effect of over-watering the vine. An adaption of method was the furrow irrigation system used in Argentina where small channels ran through the vineyard providing irrigation. This provide slightly more control since the initial amount of water entering the channels could be regulated, however the amount that each vine received was sporadic.

Sprinkler irrigation involves the installation of a series of sprinkler units throughout the vineyard, often spaced as several rows about 65 feet (20 m) apart. The sprinklers can be set on an electronic timer and release predetermined amount of water for a set period of time. While this provides more control and uses less water than flood irrigation, like furrow irrigation the amount that each individual wine receives can be sporadic. The irrigation system that provides the most control over water management, though conversely the most expensive to install, is drip irrigation. This system involved long plastic water supply lines that run down each row of vines in the vineyard with each individual grape vine having its own individual dripper. With this system, a viticulturist can control the precise amount of water that each grapevine gets down to the drop. An adaption of this system, potentially useful in areas where irrigation may be banned, is underground subirrigation where precise measurements of water is delivered directly to the root system.

10) DO-KNOW-WHAT-IRRIGATION-YOU-SYSTEMS?

11) WATER-USES-SYSTEM-LESS-WHAT?

12) MORE-WHERE-FURROW-IS-IRRIGATION-USED?