ask the AWRI

Salt damage in vineyards

Salinity and salt damage to grapevines is something growers might commonly expect to encounter after several years of drought conditions. Despite three years of generally wetter conditions, and sometimes flooded areas, growers have recently contacted the AWRI helpdesk about suspected salt damage in their vineyards. In a climate that is forecast to be drier, it is important to understand the impact that salinity can have, make sure growers are monitoring for it, and have strategies to prevent salt build-up. In this column, AWRI Senior Viticulturist **Marcel Essling** addresses some of the symptoms of salt issues in vineyards and outlines practices for managing salinity.

Q: What does salt damage look like and what effect is it having on my vineyard?

Salt toxicity typically presents as either high sodium, high chloride or a combination of both. High sodium is characterised by darkening of the leaf tissue to give an 'inky' appearance. High chloride causes necrosis, starting at the margins of older leaves and advancing towards the centre with continued accumulation. A saline soil profile affects vine performance as vine roots restrict water uptake to exclude salts, causing stress and impeding growth. Leaf necrosis signifies that the salts have surpassed the roots' exclusion mechanism, allowing toxic levels of sodium and chloride ions to enter leaf tissue.

Salty soil and irrigation water can also lead to high salt levels in the fruit, which can compromise fruit quality. The maximum permissible concentration of salt in wine produced in Australia is 1 g/L of soluble chlorides expressed as sodium chloride (no more than 606 mg/L chloride) (Standard 4.5.1 Food Standards Code).

Q: Where does the salt come from?

Salt in soil can be the result of a rising saline water table that leaves salt behind when it recedes, or from the gradual build-up in soil from salts in irrigation water. Salts concentrate in the soil when saline water is applied through drip irrigation. This occurs as roots take up water, excluding salt, and through evaporation of water from the soil surface, leaving behind concentrated salt residues. In hot and dry seasons, evaporation can be high and more irrigation is required, making the problem worse. While all irrigation water contains some salts, recent wetter seasons may have mobilised salts stored in the catchment's soils over drier years. Monitoring irrigation water quality allows the risk of future salinity problems to be assessed.

Q: How do I know if I have salt problem?

Visual signs such as stunted growth or leaf symptoms are typically the first indication of a salt issue. Regular monitoring of grapevine tissue as well as soil and water are important for observing trends and triggering action where required. Grape tissue analysis (petiole testing) provides a clear assessment of the salt being encountered by the vine at a point in time. Tests at flowering are useful because they allow time for remedial action to be taken if results indicate a salt problem. Petiole testing at veraison and juice testing are used to inform management decisions for future seasons.

Salinity is also assessed by measuring the electrical conductivity (EC) of water or soil water. If irrigation water is carrying a low salt load (<1 dS/m) and the vineyard block does not have a perched water table, encountering salinity problems is unlikely. This is especially true with good winter rainfall, as any salt build-up tends to be leached during this period. Irrigation water between 1 and 2.7 dS/m carries an increasing risk as the conductivity rises.

An indication of salt levels in soil can be gained by mixing one part dry soil with five parts distilled or deionised water. After mixing the sample and allowing the sediment to settle, the electrical conductivity of the solution is tested. An adjustment for temperature may be required. The soil texture table on the DPIRD (2022) webpage on measuring salinity can be used to interpret the salinity class of the EC measure to allow for soil texture differences. If the EC of the solution is above the threshold for the texture, a soil sample should be sent to a laboratory to get an accurate measurement. Details of how to undertake these tests and the thresholds are available in Lanyon (2011), Nicholas (2016) and DPIRD (2022). Lanyon (2011) explains other tools for extracting soil water directly.

Q: How can I manage salt build-up?

For established vineyards facing the risk of soil salinity due to salty irrigation water or when monitoring indicates increasing soil salt levels, winter leaching is the most effective strategy for managing irrigation-induced salinity in the root-zone. In wet years, salts are naturally leached from the soil profile through rainfall. However, during seasons with insufficient rainfall, irrigation can be employed to move salts below the root zone. Ideally, this should be scheduled for the end of winter because the soil profile is at its fullest and soil cracks will be minimal, preventing water loss through bypass flow, and evaporation loss will be low. Bypass flow occurs when water applied for leaching is lost down soil cracks before it can adequately mix with salts in the profile.

The amount of leaching needed depends on the existing salinity level, target threshold, soil type, evaporation rates and rainfall. If soil tests at the end of winter show unacceptable salt levels, apply several small leaching irrigations and recheck salinity. Lanyon (2011) (page 37) provides guidelines for how much extra irrigation water is required to manage soil salinity based on water quality, irrigation amount used and annual effective rainfall.

AWRI helpdesk

The AWRI helpdesk provides a free-of-charge technical advice service to Australia's grapegrowers and winemakers. For further information about salt or any other technical matter, contact the helpdesk on (08) 8313 6600 or helpdesk@awri.com.au

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DPIRD (WA Department of Primary Industries and Regional Development) 2022. Measuring soil salinity. Western Australia. Available from: https://www.agric.wa.gov.au/soil-salinity/measuring-soil-salinity. GW