



An introduction to Regulated Deficit Irrigation

Other topics in this Viti-Notes series include:

- **Limitations of Regulated Deficit Irrigation**
- **Scheduling Regulated Deficit Irrigation**
- **Varietal responses to Regulated Deficit Irrigation**

Regulated Deficit Irrigation (RDI) is primarily about restricting irrigation between fruit set and veraison to control grapevine shoot growth with the aim of influencing grape quality. Limiting water in this way forces the vine to focus on fruiting and permits manipulation of specific aspects of berry development. For example, RDI is often practiced on red wine varieties such as Shiraz where smaller berries are favoured. RDI can also be used just to manage vegetative growth in vigorous vines.

Determining what is "enough water" and just how little water means a "deficit" in your vineyard is a matter of combining technology with personal observations. Assistance can be given by consultants and equipment suppliers, and support is often available through participation in group extension activities.

To effectively apply water deficit management an understanding of the effects of irrigation at different stages of vine growth is required.

The RDI period

RDI is generally applied between fruit set and veraison - immediately after fruitset berries are developing through active cell division. Applying a water deficit at this stage limits the number of cell divisions in berries so that a significant reduction in berry size can result.

Applying water deficits at other times

Shoot growth can be stimulated at any point in the season with available soil moisture and ready uptake by the vine being the key drivers. Where reduction in vine vigour is the main interest, soil moisture levels can be managed to avoid excessive growth rates outside the recognised RDI period. Managing water

availability from budburst to flowering can reduce the size of the vine canopy, but care must be taken not to stress vines too much during this time as this can impact on bud development and early season root growth.

Regulating irrigation throughout the season

Before budburst

Water stress at this time causes buds to dry and restricts root and shoot growth. There also may be a decrease in bunch elongation with results in smaller more compact bunches which may be more susceptible to pest and disease problems. Water deficits are often difficult to apply at this time in areas with high winter/spring rainfall.

Budburst to flowering

Most regions start budburst with soils at field capacity or full of water, with ample water available to the vine. Drying deeper soil layers between budburst and flowering enables better control over vineyard water status at the critical stage post fruit set when vegetative (shoot and leaf) volume and, in some cases, berry size is targeted. The decrease in available water between budburst and flowering can be used to reduce the rate of shoot growth and to help manage vigour. In some regions, however, the amount of winter and spring rain, or high regional water tables, can make it difficult to impose such an effect.

Flowering to fruit set

In most vineyards and in most years, there is enough soil moisture stored in the soil that vines will not suffer stress during this period. However soil moisture levels during this time should be maintained at adequate levels to meet vine needs, as a good moisture status at flowering is critical.



Moisture stress at this time can significantly reduce fruit set and yields by reducing the number of berries on each bunch. This stage is short, but it is an important transition period between shoot growth and berry growth. Irrigations can be withheld during flowering to initiate the soil drying process leading up to the RDI period, providing water stress is delayed until after berry set.

Fruitset to veraison

Water stress before veraison reduces vegetative growth and berry size and increases soluble solids. It may also increase titratable acid and pH levels. This is the time when RDI offers the greatest potential to reduce excessive shoot growth. At moderate levels of water stress, vegetative growth can be greatly reduced with only a small decrease in yield. Any reduction in yield may be complemented by an increase in soluble solids, and possibly quality.

The RDI period starts when there are no remaining signs of flowering and the early stages of fruit set have been obvious for about three weeks. The deficit is initiated by allowing the soil around the majority of roots to dry out. To achieve this rapidly enough to impact on berry size it may be necessary for soil moisture to be at the dryer end of the readily available water (RAW) scale during flowering.

Irrigation should be reduced or stopped until the deficit causes shoot growth to stop or significantly close down. Too much stress will be obvious when lower leaves and tendrils drop (it is best not to get to this stage).

Monitoring soil moisture can provide a picture of stored water status and vine demand. If vines do not suffer undue stress, reduced irrigation can continue during the deficit period. Irrigation is generally increased slightly as vines approach and go through veraison.

Veraison to harvest

Low levels of water stress post veraison reduces yield by decreasing berry size, and increases in the levels of anthocyanins and phenolics may occur. The natural rate of vegetative growth is slowing at this time and water stress may result in an increase in this rate of slowing. Soil moisture needs to remain adequate during this period of growth however to ensure healthy functioning leaves to maximise the ripening process. It is a delicate balance to achieve this without restarting shoot growth and thus diverting valuable vine resources away from berries.

After harvest

Moisture controls post harvest need to be similar to those from veraison to harvest. The aim is to have enough moisture available to foster carbohydrate storage for the coming season but not so much that active vegetative growth is encouraged prior to leaf fall. There are also possible adverse effects of a deficit applied at this time on root growth, which will have consequences in the following growing season

Risk factors

Severe water stress, particularly if prolonged or occurring at key points in vine development can impact on current or future season's production in a range of ways, including:

- generally poor vigour due to reduced photosynthesis and leaves damaged from 'scalding'
- reduced root growth and cane lignification
- impacts on fruit sugar and colour development
- reduced storage of carbohydrates
- symptoms of mineral deficiencies (vines are unable to uptake nutrients close to the soil surface if soil is too dry as low water levels shut down the activity of feeder roots).

Keeping the soil too dry throughout the growing season will increase the risk of poor yield and poor quality, which makes soil moisture monitoring and an understanding of the visual symptoms of vine stress important.

Further information

Water Management for Grapevine Production: Research to Practice is a training program whose delivery can be fine-tuned to suit each region.

- Enquiries to Peter Mansfield on (08) 8222 9255 or visit www.crcv.com.au for more information.

Numerous articles about Regulated Deficit Irrigation and other water management techniques have been published in various issues of The Australian and New Zealand Grapegrower and Winemaker. Visit www.grapeandwine.com.au/ for details.

Visit the web site at www.crcv.com.au/viticare/vitinotes/ for updates and more Vitinote titles.

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