



An introduction to Regulated Deficit Irrigation

Viti-note Summary:

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Other topics in this Viti-Notes series include:

- How to start irrigating with less water
- *An introduction to Regulated Deficit Irrigation*
- 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 direct more resources from shoot growth to bunch development and permits manipulation of specific aspects of berry development. For example, RDI is often practiced on red wine varieties such as Shiraz where small 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 an aim, 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 may also be a decrease in bunch elongation resulting 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, 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 fruitset 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 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 fruitset 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 acidity 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 a relatively 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 flowering and fruit set are complete. 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 drier 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 nearly so. Too much stress will be obvious when basal 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 reduce yield by decreasing berry size, and increase in the levels of anthocyanins and phenolics may occur. Vegetative growth has generally stopped by this time. Soil moisture needs to remain adequate during this period of growth to ensure healthy functioning leaves to maximise the ripening process. It is a delicate balance to achieve this without excessive stimulation of lateral shoot growth and thus diversion of valuable 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. Therefore, soil moisture monitoring and an understanding of the visual symptoms of vine stress are important.

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Further information

Nicholas, P. 2004. Soil, irrigation and nutrition. Adelaide: Winetitles.

Articles about Regulated Deficit Irrigation and other water management techniques are available to the Australian wine industry through the Australian Wine Research Institute library. Visit <http://www.awri.com.au/contact/> for details.

For information on drought management, go to Innovator Network Resources at www.gwrdc.com.au.

Product or service information is provided to inform the viticulture sector about available resources and should not be interpreted as an endorsement.



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