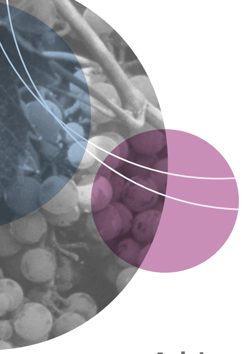

Monitoring and maintaining your drip irrigation system

Adrian Englefield; NSW DPI Development Officer – Viticulture

As an initiative of the 2018–19 Wine Australia Riverina regional program, Jeremy Giddings (Agriculture Victoria, Regional Manager – Irrigation) delivered a drip irrigation management workshop at the NSW DPI Griffith Research Station (Figure 4). Workshop attendees were introduced to key parameters for determining how efficiently a drip irrigation system is operating within design specifications.

This article outlines how to check and maintain a drip irrigation system and provides further drip irrigation resources.

Figure 4. Drip irrigation management workshop.

Drip system monitoring

Distribution uniformity (DU) is a measure of how evenly water is being delivered within an irrigation system. Poor uniformity can lead to over-watering and under-watering within the same vineyard block. To determine if irrigation is being applied evenly and within manufacturer's specifications, two simple measurements can be used to calculate dripper performance:

1. Dripper discharge: place a 50 mL measuring flask under a dripper (Figure 5) for 36 seconds and record the volume obtained.

Dripper discharge in litres per hour (L/h) = volume (36 seconds) × 100

Figure 5. Measuring dripper discharge.

2. Operating pressure: this is measured with a pressure gauge attached to a brass adaptor (Figure 6) or equivalent, which are available at most irrigation suppliers. When measuring operating pressure, ensure drippers are not damaged through excessive force. Record the operating pressure in kilopascals (kPa).

Figure 6. Measuring operating pressure.

Measuring drip system uniformity

Take nine measurements (repeat three times and use the average; Table 1) within the irrigation shift at:

- the irrigation system extremities (sub-main and lateral)
- various elevations (high and low lying areas)
- low vigour (poor vine health) or constantly waterlogged areas.

Table 1. Calculate pressure and discharge variation.

Dripper	Discharge L/h (average discharge in 36 s × 100)	Pressure (kPa)
1		
2		
3		
4		
5		
6		
7		
8		
9		
Total discharge and pressure: add up all the discharge (L/h) and pressure (kPa) readings e.g. dripper 1 + 2 + 3…	Total discharge in L/h = ______	Total pressure in kPa = ______
Average discharge and pressure: divide total discharge (L/h) and pressure (kPa) by the number of drippers	Average = ______ total discharge / ______ no. of drippers = ______ L/h	Average = ______ total pressure / ______ no. of drippers = ______ kPa
Midpoint: select the maximum and minimum dripper measurements, add these and divide by two	Midpoint = ______ max + ______ min / 2 = ______ L/h	Midpoint = ______ max + ______ min / 2 = ______ kPa
Calculate variation: subtract the minimum from the midpoint dripper measurement and divide by the midpoint. Multiply by 100 to get a %.	Variation = (______ mid - ______ min) / mid x 100 = ± ______ %	Variation = (______ mid - ______ min) / mid x 100 = ± ______ %
Acceptable variation	< ± 5%	< ± 10%

After field testing a drip irrigation system, always compare the results with the manufacturer's and irrigation designer's specifications to ensure the system is meeting these specifications.

Drip system maintenance

Drip irrigation systems only operate to design specifications if they are monitored and maintained properly. Correct dripper care prevents clogging and component deterioration, leading to a decline in vine health and yield.

Three areas of drip system maintenance include:

1. flushing
2. chlorine or hydrogen peroxide injection (oxidation)
3. acid injection.

Flushing

Drip irrigation system flushing must include the filters and delivery system in the order of water flow:

1. mainline: with sub-main and lateral valves closed, flush for two minutes or until water is clear
2. sub-main: close the mainline valve and flush for two minutes or until water is clear
3. laterals (drip line): close sub-main, flush for two minutes or until water is clear.

When flushing laterals, often two sediment deposits are released. One is the material at the end of the lateral and the other will be the disturbed material along the lateral.

Flushing frequency can vary from weekly to six monthly, depending on water quality. Filtration systems stop material greater than 130 microns from entering the irrigation system. Silt (2–50 micron) and clay (< 2 micron) should pass through the system (with proper maintenance). However, if allowed to build up, smaller particles bind together, then along with algae and bacteria, cause blockages and an uneven DU.

Determining the lateral flow rate for adequate flushing velocity

A minimum of 0.5 m/s flow velocity is recommended when flushing laterals to ensure all particles are dislodged and fully flushed

The required flow rate (L/min) for adequate flushing velocity for common lateral sizes is listed in Table 2.

With a bucket, measure the lateral flow rate for one minute. If the flow rate is less than that specified in Table 2, close a number of laterals to increase flushing velocity and re-measure until the flow rate corresponds with a velocity of 0.5 m/s.

Oxidation

Oxidation is a common term referring to injecting chemicals into a drip irrigation system to remove organic matter including algae and bacteria.

Chlorine and hydrogen peroxide are the most common oxidation agents. How frequently oxidation is required depends on water quality and checking of emitters.

Acid injection

Acid dissolves chemical deposits. Precipitated calcium salts appear as a white film inside the drip tube and outside the drippers. Generally, dilute solutions of hydrochloric or phosphoric acid are used to lower the pH to be between 2 and 4. Titrations are required to determine the required acid injection.

Note: acid should not be used with asbestos cement pipes as released fibres will block emitters.

Table 2. Flow rates required to achieve adequate flushing velocity for common lateral (drip line) sizes.

Lateral size (ID mm)	Required flow rate (L/min) for > 0.5 m/s
10.2	2.5
14.0	4.6
18.0	7.6
20.8	10.2

Calculations

Oxidation agent injection rate

Injection rate (L/h) = $\frac{\text{system flow rate (L/sec)} \times \text{required concentration (mg/L)} \times 0.36}{\text{active ingredient \%}}$

Injection rate (L/h) ÷ _______ ha = L/h/ha.

Check the flow rate via the water meter. If you are using chemicals such as chlorine and hydrogen peroxide, refer to the safety data sheets, label and irrigation designer recommendations.

Acid injection rate

1. Convert system (shift) flow rate to L/h:

   Shift flow rate: _____ L/sec (from your design) × 3,600 = _____ L/h

2. Acid required to drop pH to 3: _____ mL + 1,000 = _____

3. _____ acid required (step 2) × _____ L/h (step 1) = _____ L/h acid

4. Adjust for injection time (e.g. 15 min or 0.25 of an hour)

   _____ L/h acid (step 3) × 0.25 = _____ litre acid.

Further reading

Department of Jobs, Precincts and Regions. Testing your drip irrigation system: www.youtube.com/watch?v=qJAp1ZdRr84

Irrigation Australia. Calculators: www.irrigationaustralia.com.au/certification/calculators

Irrigation measuring and monitoring: www.tocal.nsw.edu.au/publications/list/farm-management/irrigation-measuring-and-monitoring

Irrigation scheduling: www.tocal.nsw.edu.au/publications/list/farm-management/irrigation-scheduling

Irrigation system and pump selection: www.tocal.nsw.edu.au/publications/list/farm-management/irrigation-system-and-pump-selection-agguide

NSW DPI Irrigation management: www.dpi.nsw.gov.au/agriculture/irrigation

NSW DPI PrimeFact: Maintaining a drip irrigation system for perennial horticulture: www.dpi.nsw.gov.au/agriculture/irrigation/irrigation/systems/maintaining-drip-irrigation-system

Workshop attendees received copies of NSW DPI AgGuide water series, copies are available by emailing adrian.englefield@dpi.nsw.gov.au

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