Irrigation Assessment – Wine and Table Grape Production

A major component of the *water efficiency in wine and table grape production in the Swan Valley Project* is to conduct irrigation assessments to understand and document irrigation water use practices in the grape growing industry. Irrigation systems are a vital part of the grape production industry in the Swan Valley as irrigation is required during the growing season to supplement the crops water requirements.

The irrigation assessment process was designed to:

- highlight soil water holding capacity;
- document current irrigation system performance and efficiency
- measure irrigation application rates (mm/hour or L/hour/vine);
- calculate accurate irrigation water requirements; and
- assist growers with water budgeting for dry and average rainfall years.

The data collect during the irrigation assessment was analysed and presented to the grower in a report form.

Examples of the reports for table grape and wine grape growers can be found on both the Wine Industry Association of WA website www.winewa.asn.au and Perth Region NRM website www.perthregionnrm.com.au

Step-by Step process

After the landholder registered an interest with either the Wine Industry Association of WA or Perth Region NRM, a site visit to conduct the irrigation assessment was booked in. A desktop study of the property was conducted prior to the site visit which included aerial photography of the property, property size, growing area and groundwater licensed allocation (Department of Water - water register).

Step 1: Vineyard measurements and system components

Measurements are collected for vine and row spacing, sprinkler spacing, dripper spacing, irrigation line/lateral sizes.

Information about the sprinkler and/or drip make and model is taken to compare actual performance with specified performance.

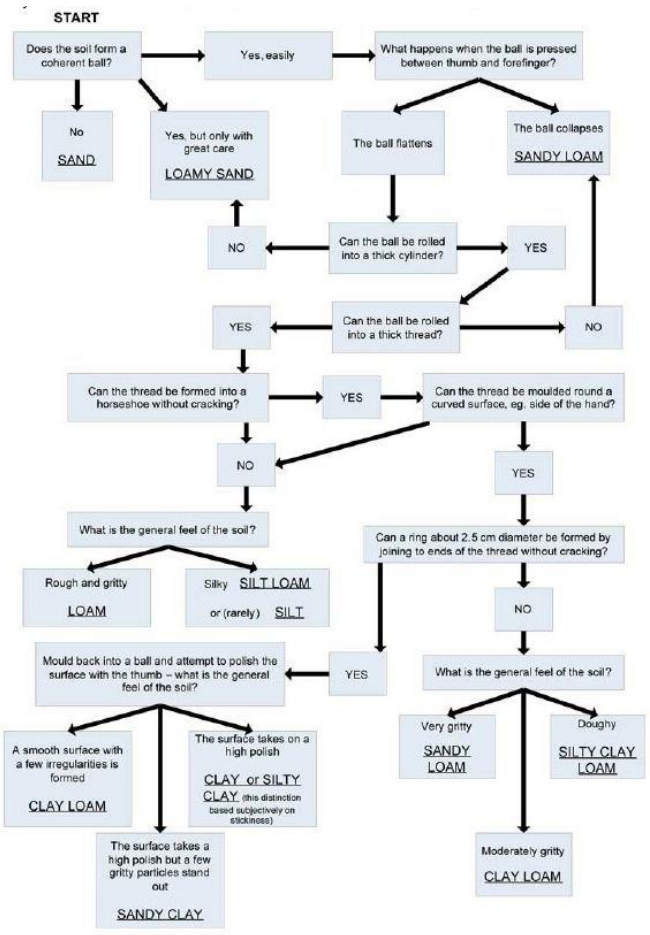
Step 2: Soil Texture and Water Holding Capacity (RAW)

The grower is consulted to identify different soil types on the property. If different soil types are identified then soil samples are taken from each area. Soil samples are taken with an auger to a depth of 70cm across the irrigation block. Several samples are grouped together to form a representative sample. Soil horizons are identified and the depth of each horizon is measured.

An assessment of soil texture is completed with the ribbon test method and flowchart methods. A moist soil sample is worked between both hands and the forefinger and thumb to form a ribbon of soil. The table used to interpret the ribbon test is included below along with the flowchart method. Photos of the soil samples were taken.

Table 1. Behaviour of moist bolus of soil when manipulated by hand

Texture	Behaviour of moist bolus	Approx clay%
SAND	Coherence nil to very slight; cannot be moulded; single sand grains adhere to fingers.	less than 5%
LOAMY SAND	Slight coherence; can be sheared between thumb and forefinger to give minimal ribbon of about 5 mm.	about 5%
CLAYEY SAND	Slight coherence; sticky when wet; many sand grains stick to fingers; will form minimal ribbon of 5 - 15 mm. Discolours fingers with clay stain.	5-10%
SANDY LOAM	Bolus just coherent but very sandy to touch; will form ribbon 15 - 25 mm; dominant sand grains are medium size and readily visible.	10-20%
FINE SANDY LOAM	Bolus coherent; fine sand can be felt and heard when manipulated; will form ribbon of 15 - 25 mm; sand grains are clearly evident under hand lens.	10-20%
LIGHT SANDY CLAY LOAM	Bolus strongly coherent but sandy to touch; sand grains dominantly medium size and easily visible; will form ribbon of 20 -25 mm.	15-20%
LOAM	Bolus coherent and rather spongy; smooth feel when manipulated but with no obvious sandiness or 'silkiness'; may be somewhat greasy to the touch if much organic matter present; will form ribbon about 25 mm.	about 25%
LOAM, FINE SANDY	Bolus coherent and slightly spongy; fine sand can be felt and hard when manipulated; will form ribbon about 25 mm.	about 25%
SILTY LOAM	Coherent bolus, very smooth and silky; will form ribbon about 25 mm.	about 25% & silt >25%
SANDY CLAY LOAM	Strongly coherent bolus sandy to touch; medium size sand grains visible in a finer matrix; will form ribbon of 25 - 40 mm.	20-30%
CLAY LOAM	Coherent plastic bolus; will form ribbon of 40 - 50 mm.	30-35%
CLAY LOAM, SANDY	Coherent plastic bolus; medium size sand grains visible in finer matrix; will form ribbon of 40 -50 mm.	30-35%
SILTY CLAY LOAM	Coherent bolus; fine sand can be felt and heard when manipulated; will form ribbon of 40 - 50 mm.	30-35% & silt >25%
FINE SANDY CLAY LOAM	Coherent bolus; fine sand can be felt and heard when manipulated; will form ribbon of 40 - 50 mm.	30-35%
SANDY CLAY	Plastic bolus; fine to medium sand can be seen, felt or heard in clayey matrix; will form ribbon of 50 - 75 mm.	35-40%
SILTY CLAY	Plastic bolus; smooth and silky to manipulate; ribbon 50 - 75 mm.	35-40% & silt >25%
LIGHT CLAY	Plastic bolus; smooth to touch; slight resistance to ribbon shearing between thumb and forefinger; will form ribbon of 50 - 75 mm.	35-40%
LIGHT MEDIUM CLAY	Plastic bolus; smooth to touch; slight to moderate resistance to ribboning shear (greater than for light clay); will form ribbon of about 75 mm.	40-45%
MEDIUM CLAY	Smooth plastic bolus; handles like plasticine; can be moulded into rods without fracture; has moderate resistance to ribboning shear; will form ribbon of 75 mm or more.	45-55%
MEDIUM HEAVY CLAY	Smooth plastic bolus; handles like plasticine; can be moulded into rods without fracture; has moderate to firm resistance to ribboning shear; will form ribbon of 75 mm or more.	>50%
HEAVY CLAY	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; has firm resistance to ribboning shear; will form ribbon of 75 mm or more.	>50%



Soil Texture has a direct link to the water holding capacity of the soil and combined with the rootzone depth (anecdotal evidence from grower and soil cores), the amount of water that can be held in the rootzone (mm) is then calculated.

The Rootzone Readily Available Water in mm of water and Litres of water is produced for the grower.

Table 2: RAW and AW values for different soil textures

Water Tension *	**To –20 kPa**	**To –40 kPa**	**To – 60 kPa**	**To –100kPa**	**To –1500 kPa**
	A	**B**	**C**	**D**	**E**
	Water-sensitive crops such as vegetables and some tropical fruits should be irrigated.	Most fruit crops and table grapes, most tropical fruits.	Lucerne, most pasture, crops such as maize and soybeans, and grapes**	Annual pastures and hardy crops such as cotton, sorghum and winter crops	AW is the total water available in the soil. Plants stress well before this level is reached
Soil texture	**Readily Available Water RAW (mm/m)**				**AW (mm/m)**
Sand	*35*	*35*	*35*	*40*	*60*
Sandy loam	*45*	*60*	*65*	*70*	*115*
Loam	*50*	*70*	*85*	*90*	*150*
Clay loam	*30*	*55*	*65*	*80*	*150*
Light clay	*25*	*45*	*55*	*70*	*150*
Medium to heavy clay	*25*	*45*	*55*	*65*	*140*

Tension is 0 kPa at saturation point. The figures are only approximate.

**(Except when partial rootzone drying is being practised on wine grapes) should be irrigated before –60 kPa is reached.

Step 3: System performance testing

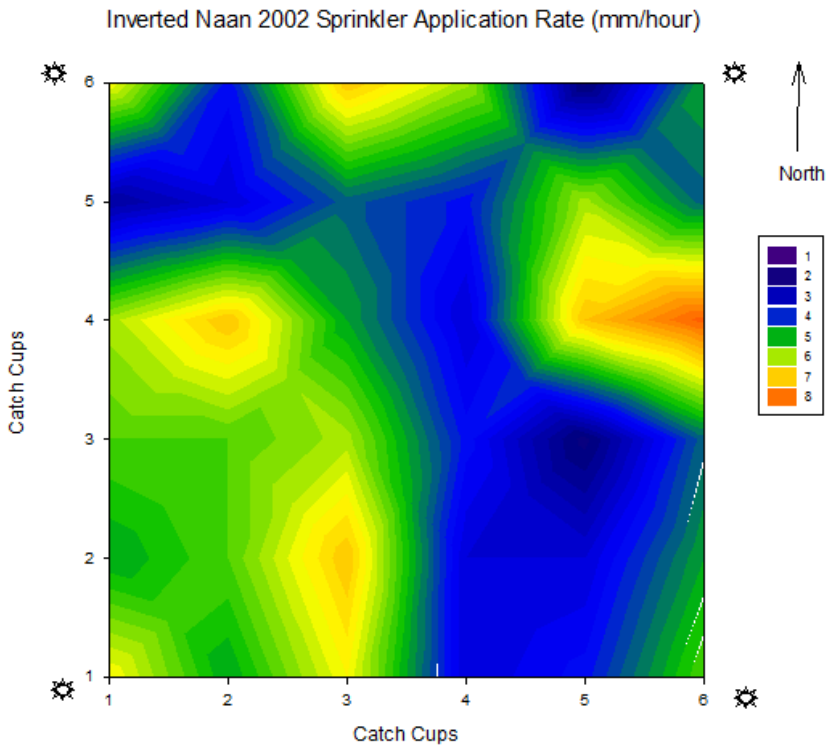
Irrigation system performance testing involves the following:

- Catch cup grid test for sprinkler systems
- Average dripper volume collected for drip systems
- Average sprinkler flow (6-8 sprinklers)
- Head, line or sprinkler pressure readings
- Wetted area calculations (sprinkler radius, drip wetting patterns)

This data is interpreted to produce:

- Mean Application Rates (mm/hour and L/vine/hour). See Application graph attached.
- Distribution Uniformity % (irrigation application evenness) – focus on dry areas
- Average sprinkler/drip flow across the block and variation in flow
- Pressure variation (kPa and psi)
- Wetted area and Readily Available Water (mm and Litres of water) based on drip wetting patterns

A Waterwise on the Farm system performance evaluation calculator/spreadsheet is used to display the system performance data with sprinkler and drip irrigation systems.



Step 4: Irrigation Scheduling

The amount of irrigation applied to the crop is calculated from daily evaporation and crop factors.

The calculations for irrigation scheduling are:

Irrigation Requirement for sprinkler systems (mm) = Daily Evaporation (mm) x crop factor

Irrigation Requirement for drip systems (L) = Daily Evaporation (mm) x crop factor x row spacing x vine spacing

Crop water requirements and irrigation runtimes are produced for the grower to guide their irrigations during the growing season.

Waterwise on the Farm irrigation scheduling calculators are used to display the monthly scheduling data.

Department of Agriculture and Food irrigation scheduling calculator is used for the production of the wine grape irrigation schedule.

Attached is a snip from the irrigation schedule produced for a table grape grower with drip irrigation.

Perth Region NRM

Trease - Early Season Table Grape
IRRIGATION SCHEDULE

WATERWISE ON THE FARM

CARING FOR OUR COUNTRY

Mean Application Rate (L/hr/tree)	14.7	Crop Factor 1	0.1		
Distribution Uniformity	91%	Crop Factor 2	0.2	Vine spacing (m)	2.5
		Crop Factor 3	0.3	Row spacing (m)	3
		Crop Factor 4	0.35		
Average Irrigation Requirement Per Month		Crop Factor 5	0.4		

	Jan**	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec**
Avg Daily Evap (mm)	10.1	10.6	7.8	5.0	3.0	2.2	2.1	2.6	3.6	6.1	7.4	9.0
Required irrigation	4.0	3.2	2.3	1.0	0.6	0.4	0.4	0.5	0.4	1.2	2.6	1.8
L/vine/day	30	24	18	8	0.0	0.0	0.0	0.0	0.0	9	19	14
Runtime per station (mins/day)	124	97	72	31	0	0	0	0	0	37	79	55
DU% runtime (mins/day)	135	107	78	33	0	0	0	0	0	41	87	60

Step 5: Water Budget

The water budget outlines the total irrigation water applied to the whole property or growing area based on average rainfall and decile 1 (driest 10% of rainfall figures) rainfall figures. If the groundwater licensed allocation amount is available for the property, a comparison can be made between the two figures. 5000kL/ha is the licensed allocation amount for table grapes and 3000kL/ha for wine grapes.

Step 6: Notes and Irrigation Tips

This section outlines issues with the irrigation system that may need addressing. Issues such as sprinkler spacing, line pressure, maintenance, sprinkler and dripper flow variations, water holding capacity, irrigation scheduling, need for soil moisture monitoring.

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