
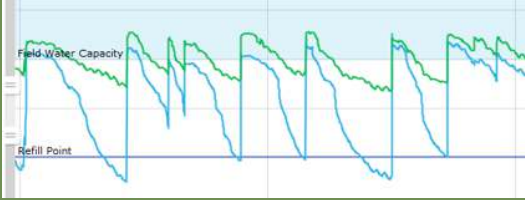


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Tools for better irrigation scheduling



... for top yields and high water productivity



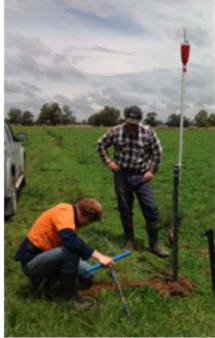
Climate webinar series
Rob O'Connor, AgVic, Echuca





1

Outline

- Background
- Evapotranspiration (ET)
 - What is it?
 - How do I use it?
 - Tools available
- Soil moisture monitoring
 - Sensor types
 - How to use the data
 - Software & data transmission packages
- Summary



2

Key Messages

- Great tools & services are available to help get irrigation right
- Both evapotranspiration (ET) & soil moisture monitoring provide objective information & help eliminate guesswork
- Objective information & other scheduling tools in your “toolbox” better enable you to get top yields & high water productivity



3

Increased interest in scheduling tools



High water prices



Upgraded irrigation supply systems



Upgraded irrigation layouts



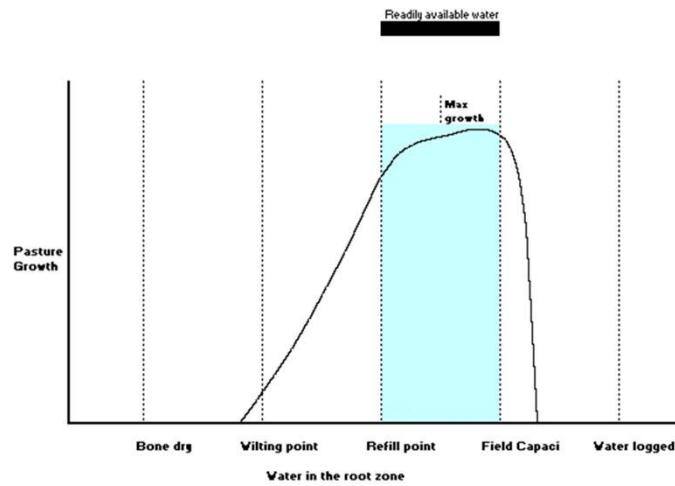
Different irrigation systems



Different crops

4

Why use irrigation scheduling tools?



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How irrigation timing is usually determined? “Tools in the toolbox”

- Experience
- Regular interval
- Time of year
- Shovel
- Neighbours ...
- Water availability
- ET
- Gut feel
- Weather conditions
- Electric fence post
- Plant indicators (wilting)
- Hay cuts
- Work-life balance
- Soil moisture monitoring

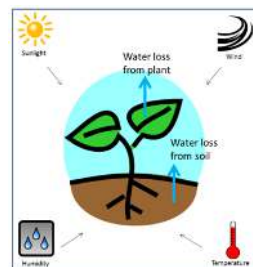


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Evapotranspiration - ET

What is ET?

- Estimate of plant water loss – from plant & soil
- Calculated using weather variables – sunshine, temp, wind & humidity
- Measured in millimetres
- Tends to be relatively consistent across flat landscape



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Evapotranspiration - ET

ET principles

- ET data usually provided as “*Reference ET*” or “*E_{T0}*”
 - the water requirement for a good, actively growing pasture stand
- The irrigation requirement of good pasture on farm = cumulative daily *E_{T0}* minus rainfall in mm
- Ballpark ‘refill point’: Pasture 40mm-50mm. Maize 60mm-70mm. Lucerne 80mm-100mm
- *E_{T0}* is multiplied by a ‘crop coefficient’ to estimate crop water requirements. Eg. 1.2 for early flowering lucerne or mature actively growing maize. 0.6 for freshly cut lucerne



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Evapotranspiration - ET

ET principles



Using ETo to schedule surface irrigation on a crop of mature actively growing maize

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	Day 8	Day 9
ETo (mm)	-	7.2	7.5	7.7	6.8	7.6	8.1	7.3	6.7	-
Kc	-	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	-
ETc (ETo x Kc, mm)	-	8.6	9.0	9.2	8.2	9.1	9.7	8.8	8.0	-
Rain (mm)	-	-	-	5.0	-	-	-	-	8.0	-
ETc-R (mm)	-	8.6	9.0	4.2	8.2	9.1	9.7	8.8	0	-
Cum ETc-R (mm)	-	8.6	17.6	21.8	30.0	39.1	48.8	57.6	57.6	-
Est RAW (mm)	60	51.4	42.4	38.2	30.0	20.9	11.2	2.4	2.4	60
Irrigation	✓	-	-	-	-	-	-	-	-	✓

Economic Development, Jobs, Transport and Resources



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Evapotranspiration - ET

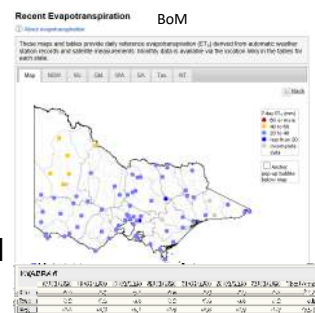
How do I use ET?

Tools

- Weekly email service
 - GMID, N.East, N. West & Gippsland
 - View on <https://extensionaus.com.au/irrigatingag/home>
- IrriSAT <http://irrisat-cloud.appspot.com>
- Other commercial tools

ET Data

- BoM <http://www.bom.gov.au/wat/eto/>
- SILO <https://www.longpaddock.qld.gov.au/silo/point-data/>
- SWAN <https://www.swansystems.com.au/>
- TheYield <https://apps.apple.com/au/app/the-yield/id1154809498>



SWAN. Good morning Robert ...

date	ETc	ETc-R	Rain	RAW	Temp	Humidity	Wind
27/03/2020	8.6	8.6	0	51.4	18	65	15
26/03/2020	7.5	7.5	0	42.4	18	65	15
25/03/2020	7.7	2.7	5.0	38.2	18	65	15
24/03/2020	6.8	6.8	0	30.0	18	65	15
23/03/2020	7.6	7.6	0	20.9	18	65	15
22/03/2020	8.1	8.1	0	11.2	18	65	15
21/03/2020	7.3	7.3	0	2.4	18	65	15
20/03/2020	6.7	-1.3	8.0	2.4	18	65	15
19/03/2020	-	-	0	60	18	65	15



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Weekly ET email service – GMID - content

LAST WEEK'S REFERENCE EVAPOTRANSPIRATION⁺ - Pasture Irrigation Requirements^{\$}

Weekly Totals – Thurs 12 Mar to Wed 18 Mar 2020

Location	ETo ⁺ (mm)	Rainfall ^R (mm)	ETo - R (mm irrigation required)	Dairy ^x pasture crop coefficient	Average ETo (mm /DAY) [^]	Required [@] Surface Irrigation Interval (days)	Spray ^{>} irrigators needed to apply (mm)
Deniliquin [*]	44	2	42	1	6.3	8	42
Kyabram [*]	32	0	32	1	4.6	11	32
Tatura [*]	35	0	35	1	5.0	10	35
Kerang [#]	32	4	28	1	4.6	10	28
Echuca [#]	30	4	26	1	4.3	10	26
Yarrawalla [#]	31	0	31	1	4.4	10	31
Numurkah [#]	30	7	23	1	4.2	10	23
Sale (Vic) ⁺	29	6	23	1	4.1	12	23

Weekly emails for different Vic regions available at: <https://extensionaus.com.au/irrigatingag/home>



Subscribe: robert.oconnor@agriculture.vic.gov.au



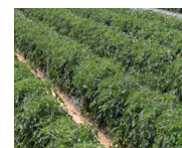
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Weekly ET email service – GMID - content

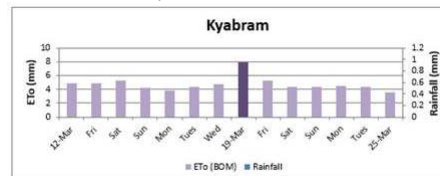
NEXT WEEK'S FORECAST REFERENCE EVAPOTRANSPIRATION⁺ Pasture Irrigation Requirements^Y

Weekly Totals – Thurs 19 Mar to Wed 25 Mar, 2020

Location	ETo (mm)	Rainfall ^R (mm)	ETo - R (mm irrigation required)	Average ETo (mm /DAY)	Required [@] Surface Irrigation Interval (Days)	Spray ^{>} irrigators will need to apply (mm)
Deniliquin	33	0	33	5.7	9	33
Kyabram	34	0	34	4.9	10	34
Tatura	38	0	38	4.7	10	38
Kerang	33	0	33	5.4	9	33
Echuca	32	0	32	5.3	10	32
Yarrawalla	32	0	32	5.7	10	32
Numurkah	35	0	35	5.0	10	35



Daily ETo & rainfall



Weekly emails for different Vic regions available at: <https://extensionaus.com.au/irrigatingag/home>

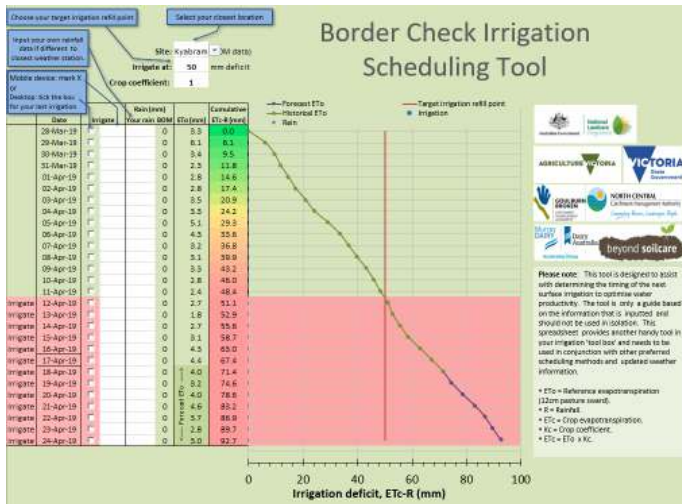


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Weekly ET email service - GMID - TOOL



Weekly emails for different Vic regions available at: <https://extensionaus.com.au/irrigatingag/home>



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Developed by Nick O'Halloran, AgVic, Tatura

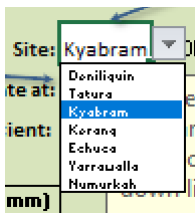


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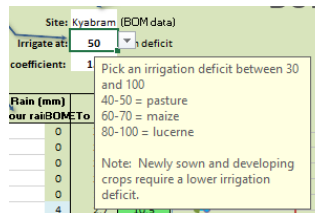
Weekly ET email service - GMID - TOOL

Using the email Spreadsheet Tool

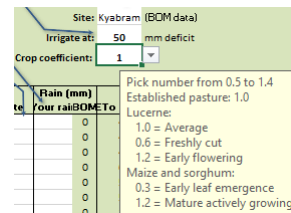
1. Select your location



2. Select irrigation deficit



3. Select crop coefficient



Weekly emails for different Vic regions available at: <https://extensionaus.com.au/irrigatingag/home>



Subscribe: robert.oconnor@agriculture.vic.gov.au



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Weekly ET email service - GMID - TOOL

Border Check Irrigation Scheduling Tool

Developed by Nick O'Halloran, AgVic, Tatura

Weekly emails for different Vic regions available at: <https://extensionaus.com.au/irrigatingas/home>

Subscribe: robert.oconnor@agriculture.vic.gov.au

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Weekly ET email service - feedback

"It's great to have a weekly reminder about irrigating"

"I use the ET email as an objective guide in combination with my shovel."

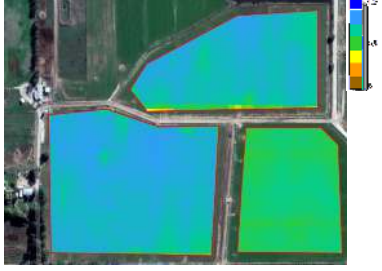
"...I'm following your advice (in the email) and I'm growing the best pastures on this place... Milk production is up ..."

Jobs, Precincts and Regions

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How do I use ET? irriSAT <https://irrisat-cloud.appspot.com/>

Crop coefficients for your paddocks



Crop water use & ETo

Date	ETc Cumulative (mm)	ETc Daily (mm)	ETD Daily (mm)
18/03/2020	241.03771	2.34773	5.4
19/03/2020	242.00229	2.56785	7
20/03/2020	242.26647	1.98091	5.4
21/03/2020	247.42523	1.97089	5.1
22/03/2020	246.21814	1.70081	4.8

Next Week: No precipitation throughout the week			
Day	Weather	ET _c (Tall)	Rain
Today	Clear throughout the day	6.2 mm	
Tomorrow	Mostly cloudy throughout the day	3.5 mm	1%
Wed	Clear throughout the day	4.7 mm	2%
Thu	Clear throughout the day	4.4 mm	
Fri	Mostly cloudy throughout the day	3.9 mm	2%
Sat	Partly cloudy throughout the day	4.2 mm	2%
Sun	Mostly cloudy throughout the day	3 mm	13%
Mon	Clear throughout the day	3.5 mm	7%


Enter irrigation & rainfall

Irrigation

FR 47 mm

Rainfall - via SILO

Sun 22nd Yesterday 0 mm




Provides next irrigation date

Given a refill point of **-40 mm**, your refill point will be reached in **more than 7 days** time

Refill Point

-40 mm



Today's Soil Water Deficit

-5.54 mm

Field Capacity


0 mm

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Soil Moisture Monitoring


Sensors



Gypsum block



Capacitance probe



Capacitance (TDR) Spike

VICTORIA
State Government


Jobs, Precincts and Regions

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Soil Moisture Monitoring

G-Dot




G-Dot

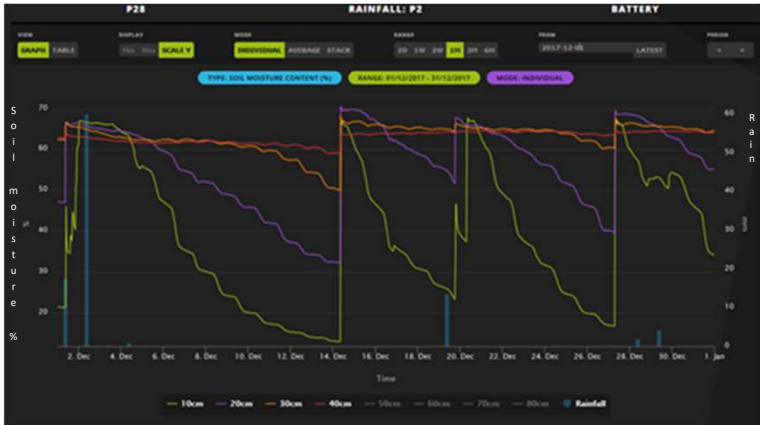





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Soil moisture monitoring



Capacitance probe under surface irrigated pasture – individual depths Actual screen-shot



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Soil moisture monitoring



Capacitance probe under surface irrigated pasture – average

Actual screen-shot

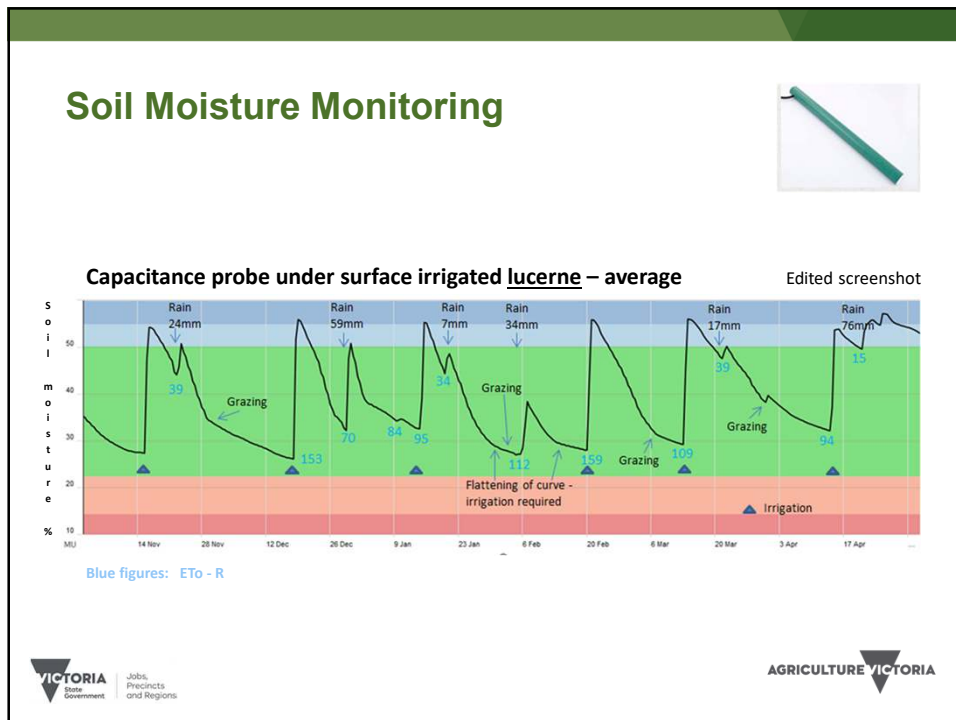


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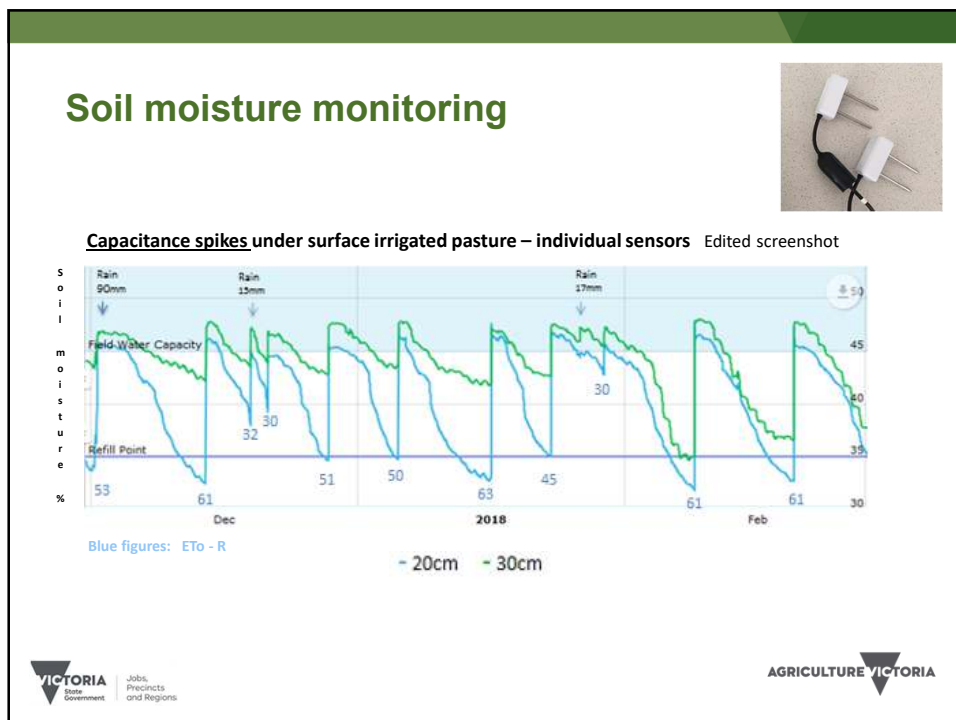
Conjunctive use of scheduling tools



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Soil moisture monitoring - feedback

"I look at the soil moisture readings all the time (- & use it for different purposes related to irrigation scheduling)."

"I'm happy with the probes. There's definitely a place for them. They give you more confidence with your decisions."

"We've got good feed from our bays this year and a lot of it is due to good irrigation management."



Jobs,
Precincts
and Regions

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Soil moisture monitoring

Financial incentive – for Shepparton Irrigation Region

- Up to \$5,000 incentive per farm
- For pressurised & surface irrigation systems
- Dollar for dollar basis (50%)
- Available for a limited time
- Contact AgVic Tatura Ph 5833 5222 or rabi.maskey@agriculture.vic.gov.au



Jobs,
Precincts
and Regions



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Smarter Irrigation for Profit – Phase 2 On-farm irrigation technology trials

- 10 dairy “Optimisation Sites”, Vic, NSW, Qld & SA
- Murray Dairy Region - 2 sites
 - 1) Surface irrigation. Maize & ‘winter crop.’ Tongala
 - 2) Centre pivot site. Double cropped
- Involve soil moisture monitoring, weather based tools & crop yield measurement
- Communication: Field days, monthly irrigation reports, DA & SIFP web sites



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Irrigation scheduling - Tool summary

Scheduling tool	Pros	Cons	Practicalities
ET 	Free High confidence Applies to large area Forecast data	Crop coefficient Grazing /hay cutting Spring irrigation start-up Some data source variability	Data readily accessible No install or maintenance Intuitive Conjunctive use advised
Soil moisture monitoring	Different depths Spring irrigation start-up Grazing /Hay cutting Record of irrigations	Upfront & ongoing costs Small soil volume Install & maintenance Temperature sensitivity	Remote monitoring Choice software packages Protection - stock/machine Training & back-up
Capacitance probe 	Long life Depth multiples	Volumetric measurement Higher upfront cost	Installation difficult Soil temperature measurement
Gypsum block 	Measures tension Cheaper sensor	Limited lifetime Potential reading lag period	Installation can be difficult
TDR 	Cheaper sensor Cheaper telemetry available	Volumetric measurement Annual subscription cost	Easier to install Simple software available

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Over-all Summary

- Irrigators already use a range of irrigation scheduling tools
- The addition of ET data & soil moisture monitoring provides objective and useful information
- Objective information, along with the other tools in your “scheduling toolbox” better enables you to get top yields & high water productivity



Further information

- **ET email service:** <https://extensionaus.com.au/irrigatingag/home> or subscribe to robert.oconnor@agriculture.vic.gov.au (Phone: 03 5482 1922)
- **ET fact sheet:** <http://agriculture.vic.gov.au/agriculture/farm-management/soil-and-water/irrigation>
- **Soil moisture monitoring fact sheet:** <https://www.dairyaustralia.com.au/farm/animal-management/technologies/pasture-and-feeding-technologies>