

# IRRIGATION SCHEDULING IN FLOWER CROPS



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# IRRIGATION SCHEDULING

***HOW OFTEN AND HOW MUCH WATER IS APPLIED TO A CROP***





# WEATHER CONDITIONS

## EVAPORATION/EVAPOTRANSPIRATION

### *COMBINED EFFECT OF:*

WIND SPEED

RELATIVE HUMIDITY

TEMPERATURE

SOLAR RADIATION



# EVAPOTRANSPIRATION

CALCULATED FROM MEASURED WEATHER DATA

$$ET_o = \frac{0.408\Delta (R_n - G) + \gamma \frac{900}{T + 273} u_2 (e_s - e_a)}{\Delta + \gamma(1 + 0.34 u_2)}$$

# WHERE EVAPORATION/EVAPOTRANSPIRATION DATA COMES FROM



FROM ONSITE WEATHER STATION

OR

FROM BOM WEBSITE

**Recent Evapotranspiration**

These maps and tables provide daily reference evapotranspiration (ET<sub>0</sub>) derived from automatic weather station records and satellite measurements. Monthly data is available via the location links in the tables for each state.

Map: NSW Vic Qld WA SA Tas NT

**Evapotranspiration Calculations**

Bundaberg Aero - September 2016 daily calculations

Date	Evapotranspiration (mm) 0000-2400	Rain (mm) 0000-0900	Pen. Evaporation (mm) 0000-0900	Max Temp	Min Temp	Max Rel Hum (%)	Min Rel Hum (%)	Average 10m Wind Speed (m/sec)	Solar Radiation (MJ/m <sup>2</sup> m)
01/09/2016	3.1	0.0		24.7	15.2	85	51	2.32	13.38
02/09/2016	4.3	0.2		26.2	18.2	84	55	5.63	16.26
03/09/2016	4.5	10.0		25.1	19.7	95	49	4.29	20.02
04/09/2016	4.8	0.0		24.7	12.3	80	29	3.60	21.20
05/09/2016	4.7	0.0		24.6	12.4	84	41	5.25	19.62
06/09/2016	5.2	0.0		24.3	14.3	88	34	5.71	21.33
07/09/2016	5.0	0.0		26.2	13.1	93	37	5.31	21.26
08/09/2016	4.0	3.4		24.8	16.4	97	55	5.18	19.48
09/09/2016	3.1	1.8		24.7	16.3	87	58	4.44	16.56
10/09/2016	3.6	0.6		25.8	17.3	88	59	3.87	16.63
11/09/2016	4.1	12.8		25.5	16.9	97	39	2.91	21.20
12/09/2016	3.8	0.2		26.6	14.3	99	55	2.36	19.59
13/09/2016	3.9	0.2		26.6	15.4	89	52	2.83	19.66
14/09/2016	4.1	0.0		26.7	16.6	95	57	4.24	18.91
15/09/2016	3.3	4.0		26.7	16.1	98	62	3.76	13.71
16/09/2016	4.6	0.2		28.0	18.0	93	48	3.74	18.86
17/09/2016	4.7	0.0		26.2	14.8	88	45	3.70	22.47
18/09/2016	2.5	0.0		24.9	20.0	91	69	3.90	7.09
19/09/2016	3.0	0.2		24.2	19.7	94	51	2.76	11.09
20/09/2016	3.1	0.0		26.7	16.1	88	53	2.12	12.73
21/09/2016	3.1	0.6		26.8	18.0	90	61	3.76	9.93
22/09/2016	5.6	0.2		27.7	17.2	96	29	3.61	23.83
23/09/2016	5.5	0.0		27.1	13.1	86	27	3.51	24.67
24/09/2016	5.5	0.0		27.8	11.8	80	31	3.86	23.66
25/09/2016	3.8	0.0		28.1	19.7	97	57	3.81	13.91
26/09/2016	5.5	14.6		27.7	14.4	84	26	3.10	24.38
27/09/2016	5.5	0.0		27.7	15.1	85	17	3.02	19.07
28/09/2016	6.5	0.0		28.1	10.7	74	18	4.00	24.46
29/09/2016	3.8	0.0		27.0	17.1	91	52	3.55	9.93
30/09/2016	6.6	12.2		36.2	19.4	95	15	4.00	24.14
<b>Totals</b>	<b>130.8</b>	<b>66.2</b>							

Monthly Archive

**Related links**

- FAO Irrigation and drainage paper 60
- Water and the Land feedback page

The background of the slide is a light gray gradient. It is decorated with numerous realistic water droplets of various sizes. Some droplets are large and prominent, while others are small and subtle. They are scattered across the slide, with a higher concentration in the top-left and bottom-right corners, and a few in the center. Each droplet has a clear highlight and a soft shadow, giving it a three-dimensional appearance.

# RAINFALL

NEEDS TO BE MEASURED

REQUIRED IF USING INDIRECT MEASURING SCHEDULING TOOLS



# SOIL/ SUBSTRATE CHARACTERISTICS

**SOIL HAS DIFFERENT PROPERTIES TO SUBSTRATES**

## ***LIMITATIONS***

INFILTRATION RATE OF SOIL

ABSORPTION RATE OF SUBSTRATES

MOISTURE HOLDING





# **SOIL INFILTRATION RATES**

**WATER MOVING FROM THE SOIL SURFACE INTO THE SOIL PROFILE**

**SOIL TEXTURE – SANDS HIGHER THAN CLAYS**

**SOIL MOISTURE CONTENT – DRIER SOILS HAVE HIGHER INFILTRATION RATES**

**SOIL STRUCTURE – COMPACTED SOILS IMPEDE INFILTRATION**

**SOIL SURFACE CONDITIONS – MULCHES IMPROVE INFILTRATION**





The background of the slide is a light gray gradient, decorated with numerous realistic water droplets of various sizes. Some droplets are at the top, some at the bottom, and some on the sides, creating a fresh and clean aesthetic.

# SOIL INFILTRATION RATES

**EXCEEDING INFILTRATION RATE LEADS TO RUNOFF**

LOSS OF WATER

EROSION

ENVIRONMENTAL IMPACTS

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# SOIL INFILTRATION RATE

LOW  $< 15$  mm/hr

MEDIUM 15 TO 50 mm/hr

HIGH  $> 50$  mm/hr



# SUBSTRATE ABSORPTION RATE

***WATER BEING ABSORBED INTO THE PARTICLES OF SUBSTRATES***

SUBSTRATE COMPONENTS – BARK < COIR

SUBSTRATE MOISTURE CONTENT – DRIED SUBSTRATE MAY BE WATER  
REPELLENT

PROPERTIES CHANGE OVER TIME





# SUBSTRATE ABSORPTION RATE

## ***EXCEEDING ABSORPTION RATES***

LOSS OF WATER AS EXCESS DRAINAGE

INCREASED LEACHING OF NUTRIENTS

ENVIRONMENTAL IMPACTS



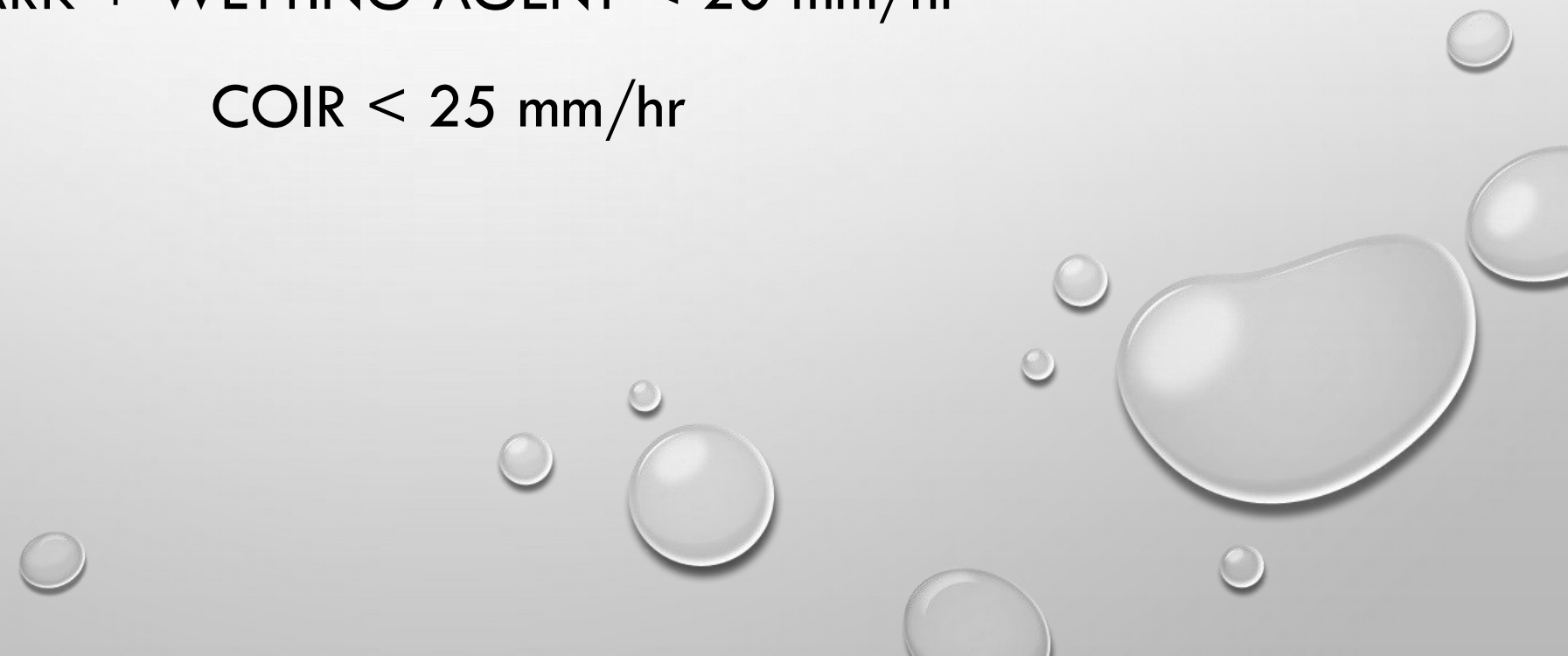


# SUBSTRATE ABSORPTION RATE

BARK < 15 mm/hr

BARK + WETTING AGENT < 20 mm/hr

COIR < 25 mm/hr





# MOISTURE HOLDING OF SOIL/ SUBSTRATES

**AMOUNT OF WATER HELD IN SOIL/SUBSTRATE**

EACH SOIL TYPE/SUBSTRATE IS DIFFERENT

HOW OFTEN AND HOW MUCH TO APPLY





# IRRIGATION SYSTEM FACTORS

MEAN APPLICATION RATE - MAR

DISTRIBUTION UNIFORMITY - DU



The background of the slide is a light gray gradient, decorated with numerous realistic water droplets of various sizes. Some droplets are at the top, some at the bottom, and some are clustered together, creating a fresh and clean aesthetic.

# IRRIGATION SYSTEM FACTORS

**MEAN APPLICATION RATE – MAR mm/hr**

*How quickly the water is applied*

IF EXCEEDS SOIL INFILTRATION RATE RUNOFF OCCURS

IF EXCEEDS SUBSTRATES ABSORPTION RATE EXCESSIVE DRAINAGE  
OCCURS




# IRRIGATION SYSTEM FACTORS

## DISTRIBUTION UNIFORMITY - % DU

***UNIFORMITY OF IRRIGATION ACROSS THE IRRIGATED AREA***

% DU	Extra minutes of irrigation per hour of irrigation
70	27
75	20
80	15
85	11
90	7
95	3



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# SCHEDULING TECHNIQUES

## PULSING

***MULTIPLE SHORT APPLICATIONS TO REDUCE THE VOLUME OF WATER  
APPLIED AT ONE TIME***

USEFUL FOR DRIPPERS

MAY HAVE APPLICATIONS FOR SPRINKLERS IN CERTAIN SITUATIONS



# SCHEDULING TOOLS

SHOVEL OR AUGER

DAILY EVAPORATION/ WEB TOOLS

TENSIOMETERS

GYPSUM BLOCKS

CAPACITANCE PROBES

TIME DOMAIN REFLECTOMETRY

RADIOACTIVE REFLECTION

WETTING FRONT DETECTOR



# SCHEDULING TOOLS

## SHOVEL OR AUGER







# SCHEDULING TOOLS

## SHOVEL OR AUGER

### *ADVANTAGES*

LOW COST

ABILITY TO SAMPLE MULTIPLE SITES



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# SCHEDULING TOOLS

## SHOVEL OR AUGER

### ***DISADVANTAGES***

PERSONAL OPINION - SUBJECTIVE

CAN'T COMPARE PREVIOUS RESULTS

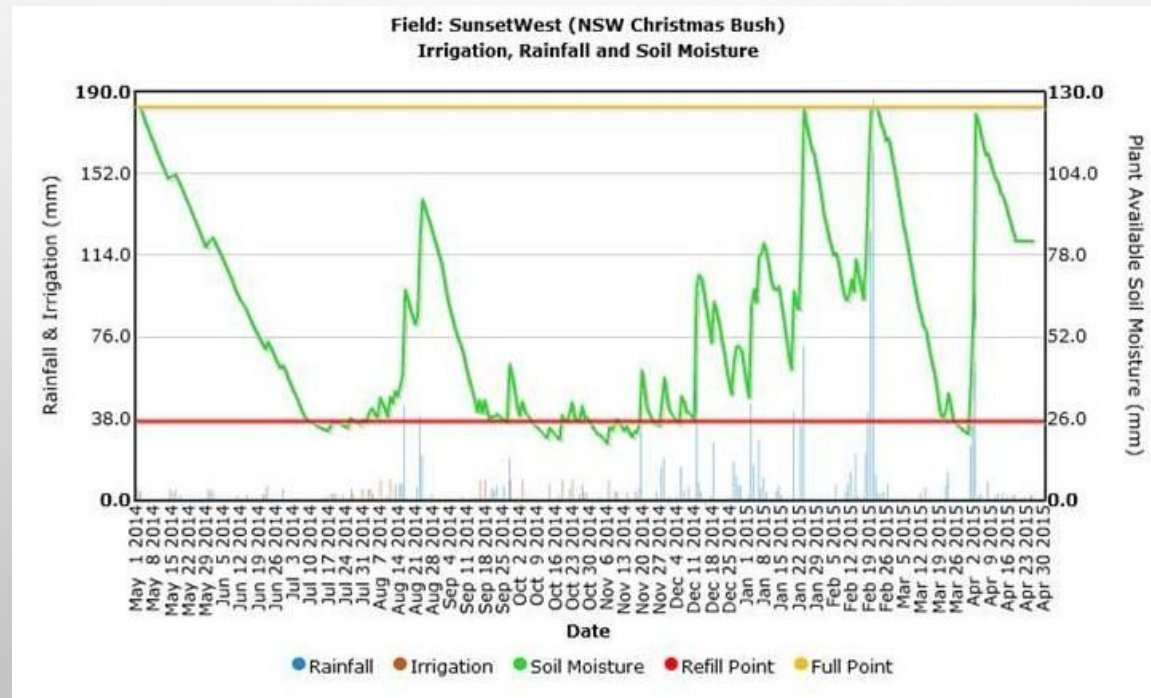
CAN'T GET CONTINUOUS RESULTS

HARD TO ESTABLISH WATER USE PATTERNS

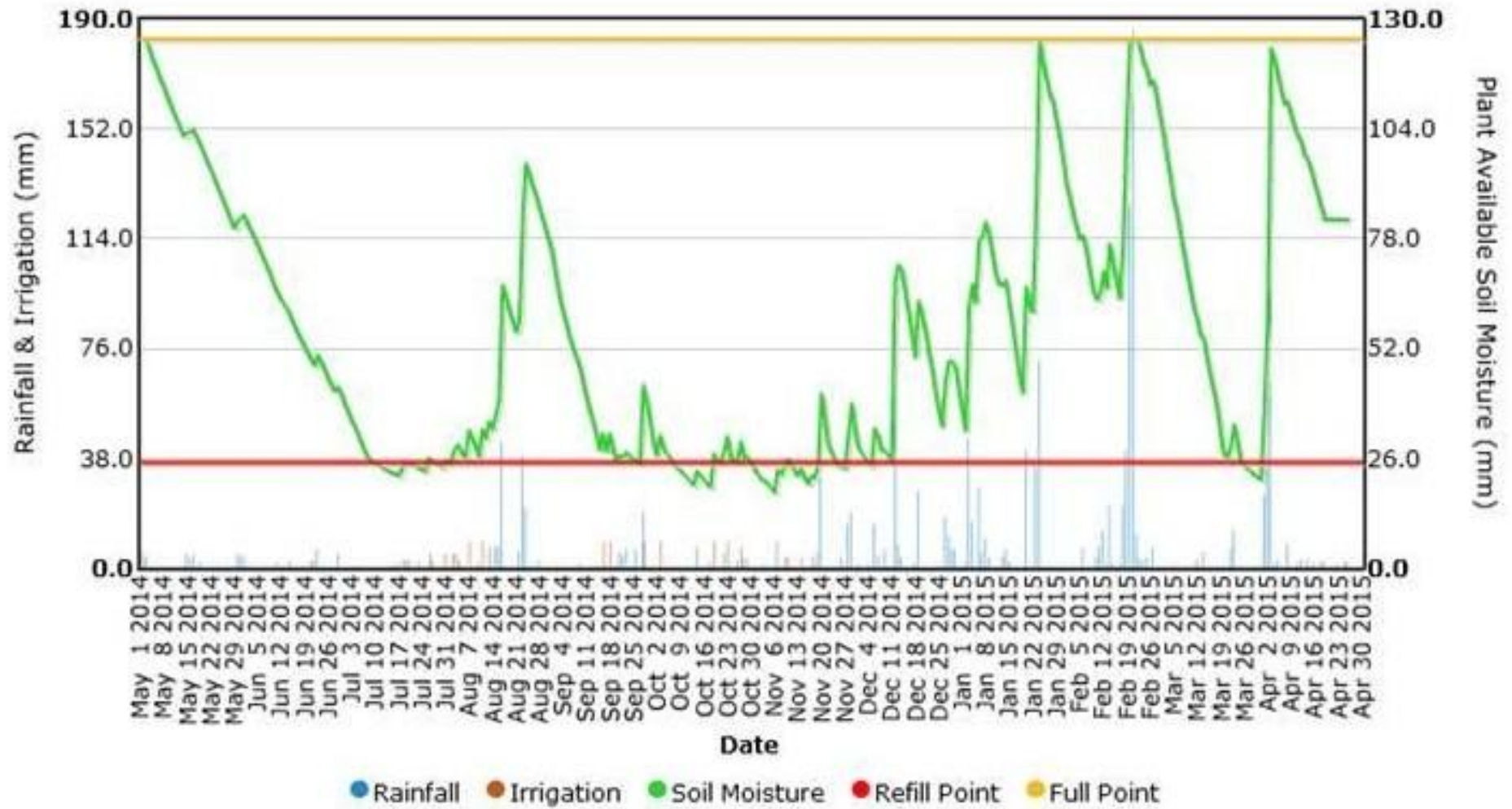
# SCHEDULING TOOLS

## DAILY EVAPORATION/WEB TOOLS

### *SCHEDULING IRRIGATION DIARY - SID*



Field: SunsetWest (NSW Christmas Bush)  
Irrigation, Rainfall and Soil Moisture





# SCHEDULING TOOLS

## DAILY EVAPORATION/WEB TOOLS

### *ADVANTAGES*

LOW COST

USEFUL FOR SCHEDULING NEXT IRRIGATION

RESULTS DIRECTLY RELATE TO WEATHER CONDITIONS

CAN LOOK BACK AT HISTORY





# SCHEDULING TOOLS

## DAILY EVAPORATION/WEB TOOLS

### *DISADVANTAGES*

RELIES ON ESTIMATES OF WATER USE

NEED TO BE CLOSE TO A WEATHER STATION

ONLY SUITABLE FOR CROPS IN SOIL





# SCHEDULING TOOLS

## TENSIOMETERS





# SCHEDULING TOOLS

## TENSIOMETERS

### *ADVANTAGES*

LOW COST

MULTI-DEPTH

CAN BE LOGGED AND RESULTS COMPARED





# SCHEDULING TOOLS

## TENSIOMETERS

### *DISADVANTAGES*

HIGH LABOUR IF NOT LOGGED

FREQUENT READING FOR GOOD DATA

HIGH MAINTENANCE

MUST BE INSTALLED CORRECTLY

HARD TO ESTABLISH WATER USE PATTERNS



# SCHEDULING TOOLS

## GYPSUM BLOCKS





# SCHEDULING TOOLS

## **GYPSUM BLOCKS**

### ***ADVANTAGES***

LOW COST

ACCURATE

LOGGABLE

MULTIPLE DEPTHS

BETTER IN FINELY TEXTURED SOILS THAN TENSIOMETERS



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# SCHEDULING TOOLS

## **GYPSUM BLOCKS**

### ***DISADVANTAGES***

REPLACE AFTER 2-3 SEASONS

HIGH LABOUR IF NOT LOGGED

CALIBRATION NEEDED

SOIL PROFILE DISTURBED DURING INSTALLATION

HARD TO ESTABLISH WATER USE PATTERNS



# SCHEDULING TOOLS

## CAPACITANCE PROBES

*A NUMBER OF DIFFERENT UNITS AVAILABLE*

*RANGE FROM SIMPLE READING LIKE TENSIO-METER TO DATA LOGGING AND REMOTE ACCESS.*





# SCHEDULING TOOLS

## CAPACITANCE PROBES

### *ADVANTAGES*

ACCURATE

CONTINUOUS LOGGING DATA

MULTI-SITES, MULTI-DEPTH





# SCHEDULING TOOLS

## CAPACITANCE PROBES

### *DISADVANTAGES*

LIMITED SITES AND DEPTHS

DOWNLOADING DATA

REQUIRES SKILL TO INSTALL AND INTERPRET





# SCHEDULING TOOLS

## **TOOLS FOR SUBSTRATES**

DIRECT SOIL MOISTURE MEASURING EQUIPMENT UNSUITABLE

ESTIMATES OF WATER USE OR WEIGHING CONTAINERS



# SCHEDULING TOOLS





# OTHER FACTORS

TIME OF USE TARIFFS

SELF-GENERATED SOLAR POWER

OTHER ACTIVITIES - SPRAYING AND HARVESTING

SYSTEM CONTROL - MANUAL OR AUTOMATIC

KEEPING FOLIAGE DRY

DOWNTIME FOR REPAIR AND MAINTENANCE

WATER AVAILABILITY

WATER QUALITY





# MORE INFORMATION

## Cut flowers Farm Management System reference guide



*References and contacts for industry best practice, environmental and economic success*







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