

MANEJO DEL RIEGO



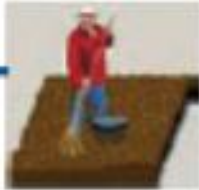
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superficie del suelo

Manejo



Prácticas de manejo de campo

- Nivel de fertilidad del suelo
- Prácticas que afectan el balance de agua del

Prácticas de manejo de riego

- Método de riego
- Tiempo y profundidad de la aplicación de los eventos de riego
- Salinidad del agua de riego



Irrigation management

Analizar y evaluar la producción del cultivo y el manejo y uso del agua bajo 2 condiciones: de seco o de riego.

Selección de los modos de crecimiento del cultivo

☐ Rainfed cropping (no irrigation in season)



☐ Determination of Net irrigation water requirement



☐ Irrigation schedule



when

irrigation applications.....user defined

quantity

quality (salt content)

☐ Generation of
Irrigation schedule



when

irrigation applications.....

quantity

quality (salt content)

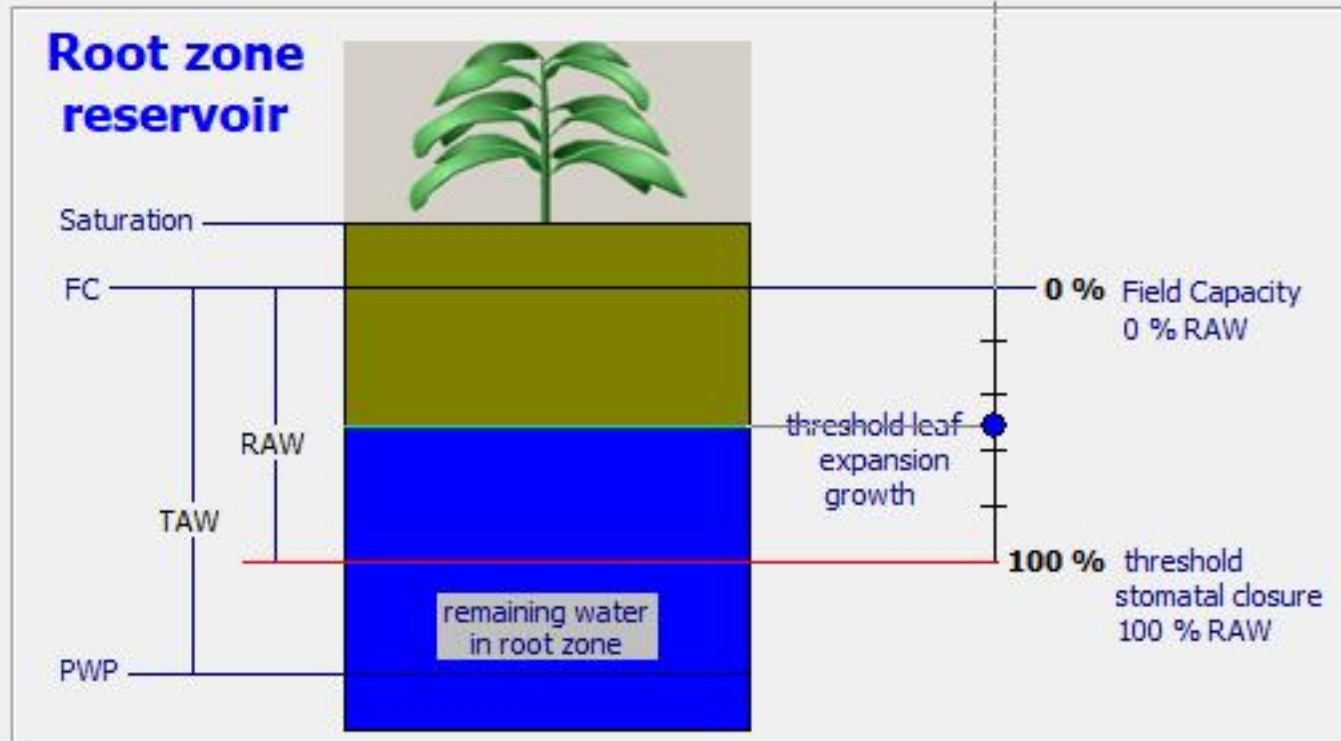
Necesidades o requerimientos netos de riego

$$N_n = ET_c - P_{p ef}$$

No considera el agua extra que tiene que ser aplicada al cultivo para compensar las pérdidas por conducción o desigual distribución del agua de riego en el campo.

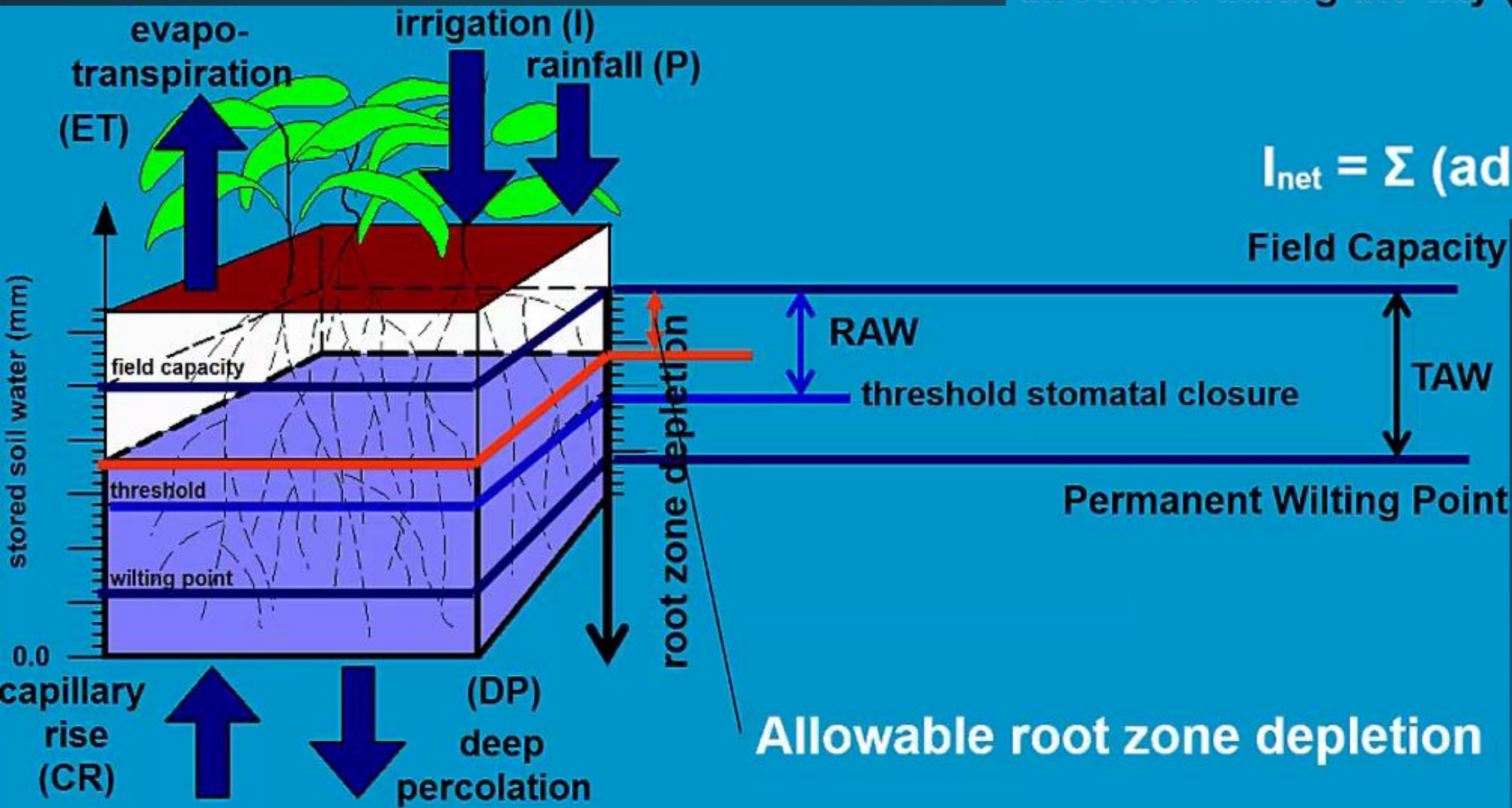
Allowable root zone depletion

root zone depletion may not drop below % RAW



RAW: máxima cantidad de agua que el cultivo puede extraer sin inducir al cierre de los estomas y la reducción de la transpiración.

When the root zone depletion exceeds the allowable depletion, water is added to the root zone to keep the depletion at the threshold during the day (time step)



SIMULACIÓN AQUACROP

TOMATE: Clima Valenzano

Suelo Silty clay

Fecha de transplante: 1/10

Secano y con riego



Tomato page 192 - 198

Dry matter content of fresh fruit ranges from 4.0 to 7.0 percent

Dry yield \approx 10 ton per hectare

Fresh yield $\approx 10/0.070 \approx 145$ ton per hectare

PROGRAMA DE RIEGO

Irrigation schedule

Mode | Irrigation method | Irrigation events |

Irrigation method

☐ Sprinkler irrigation

☒ Surface irrigation

☐ Basin irrigation

☐ Border irrigation

☒ Furrow irrigation

☐ Drip irrigation

indicative values

percentage of soil surface wetted

Soil surface
wetted
%

Irrigation Method

Sprinkler :

- Sprinkler irrigation 100

Surface :

- Basin irrigation 100

- Border irrigation 100

- Furrow irrigation (every furrow), narrow bed... 60 - 100

- Furrow irrigation (every furrow), wide bed..... 40 - 60

- Furrow irrigation (alternated furrows) 30 - 50

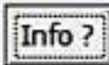
Drip :

- Trickle/Drip - Micro irrigation 15 - 40

- Subsurface 0

Close

adjustment for partial wetting



Percentage of soil surface wetted.

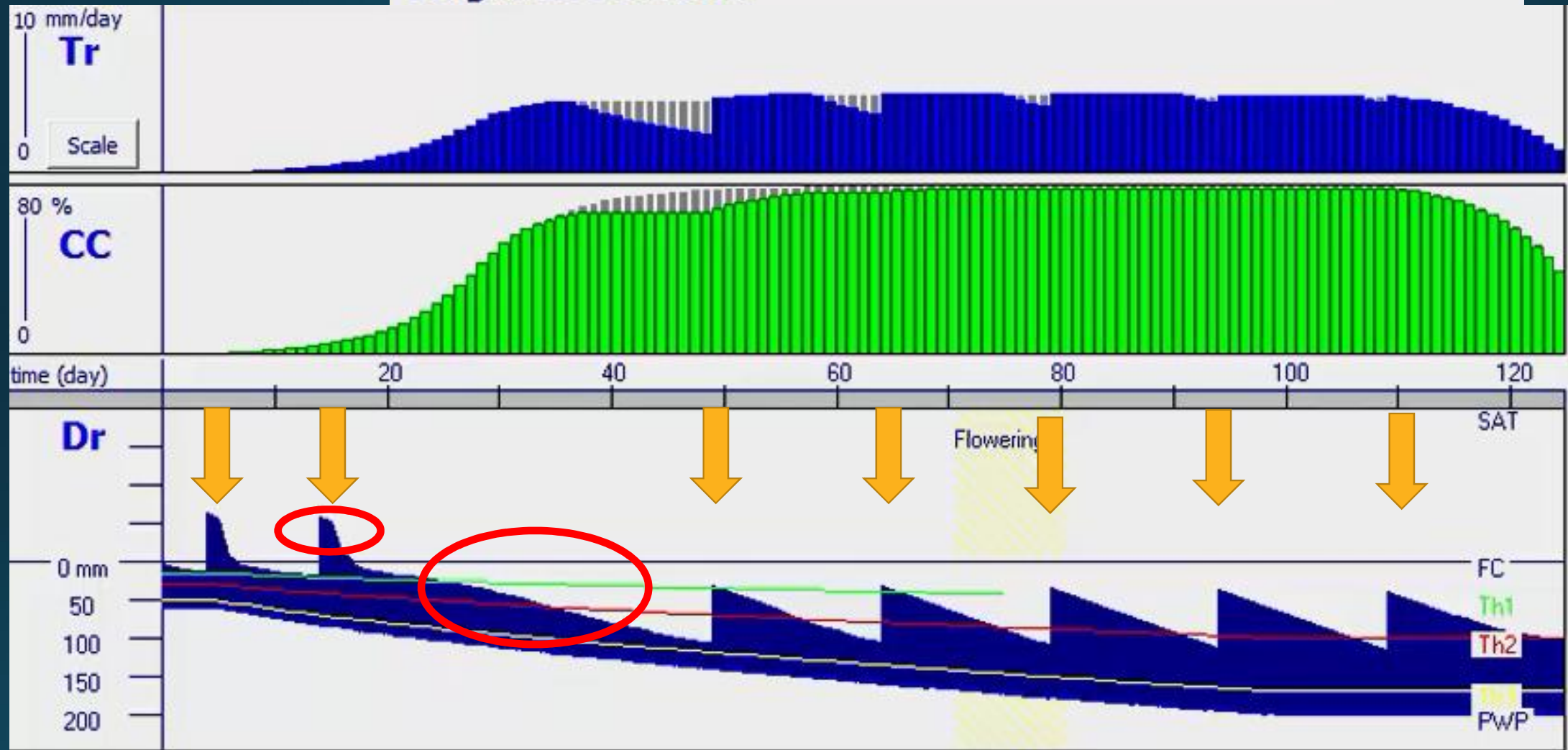


80



.. %

Irrigation schedule



Day No. 125 - maturity: 24 July

Clear All Events

	Evaluated schedule		
Biomass [ton/ha]	14.3		
Dry yield [ton/ha]	7.5		
Irrigation [mm]	525		
WP_{ET} [kg/m ³]	1.44		
Harvest Index [%]	52.5		

Irrigation schedule

Mode | Irrigation method | Irrigation events

Irrigation events

Add 1 events

Irrigation water quality excellent

EC_w 0.0 dS/m

assign

Day No. 1 - day 1 after sowing: 22 March



When?

Depth?

Quality

Event	Date	Day No.	Net application (mm)	dS/m
1	26 March	5	50	0.0
2	5 April	15	50	0.0
3	20 April	30	50	0.0
4	10 May	50	75	0.0
5	25 May	65	75	0.0
6	9 June	80	75	0.0
7	24 June	95	75	0.0
8	9 July	110	75	0.0

Growing cycle



Canopy Cover

Plot events

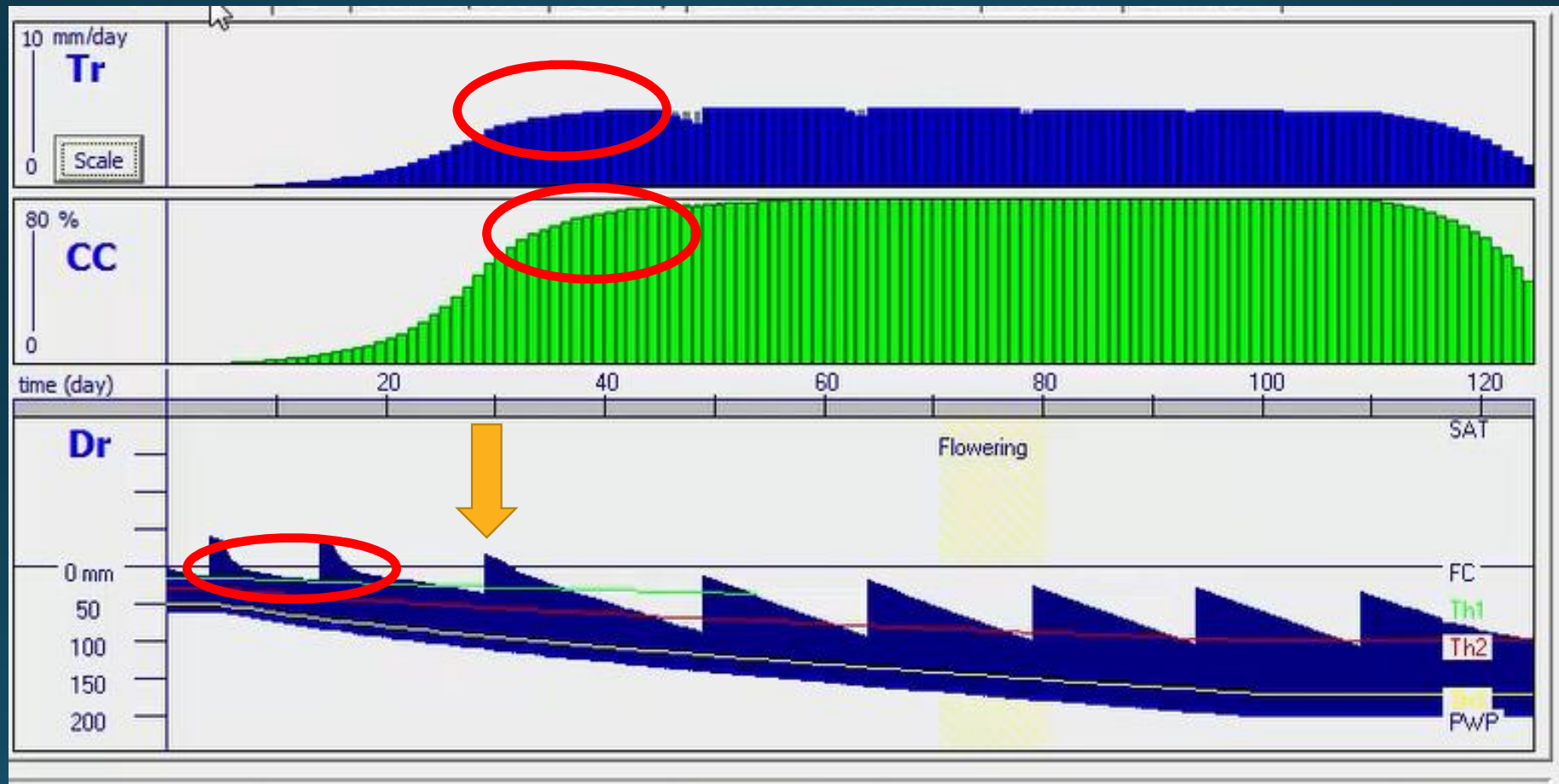
Day No. 125 - maturity: 24 July

Clear All Events

Nuevo programa de riego

- Reducir láminas de riego en días 5 y 15
- Agregar un riego en el día 30.

1º alternativa de riego



	Evaluated schedule	1 st update	
Biomass [ton/ha]	14.3	15.4	
Dry yield [ton/ha]	7.5	7.7	
Irrigation [mm]	525	525	
WP_{ET} [kg/m ³]	1.44	1.37	
Harvest Index [%]	52.5	50.2	

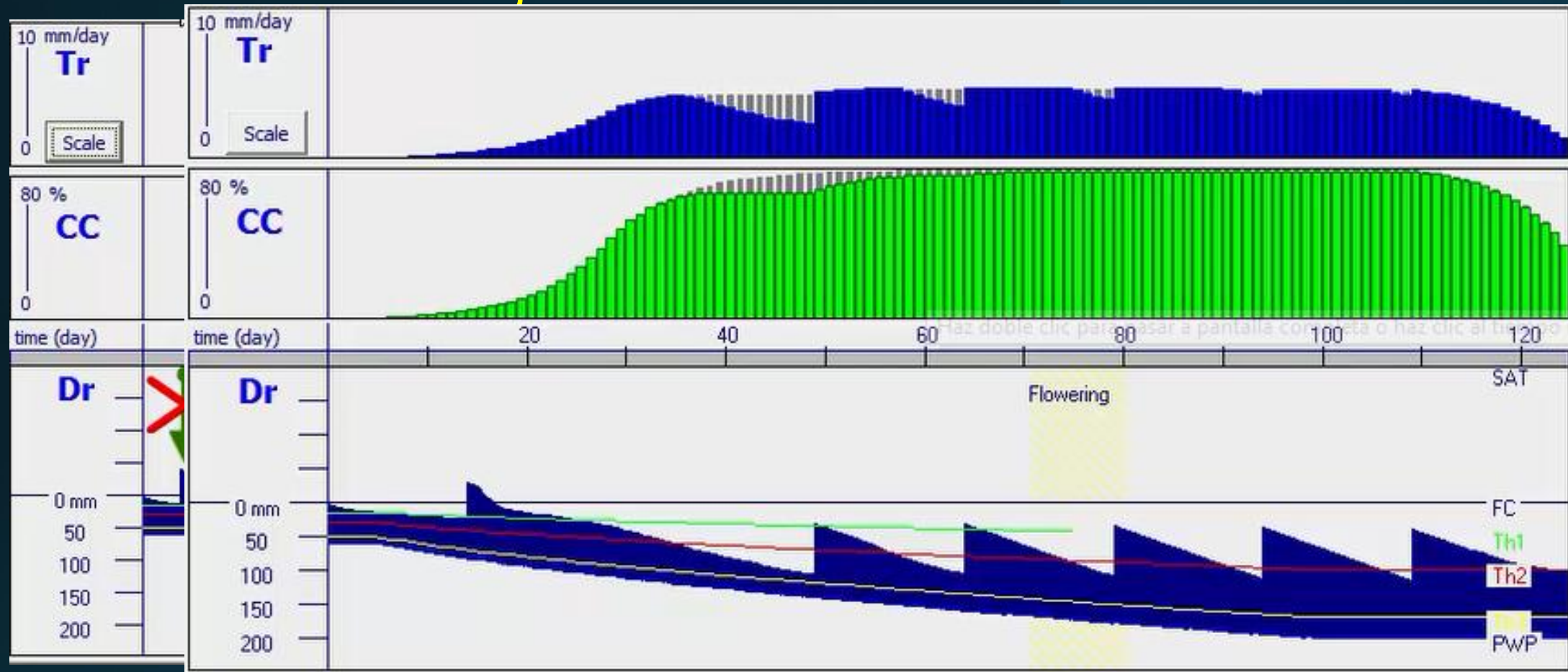
Leve incremento del
rendimiento

ET water productivity

0.00 kg (yield) per m³ water evapotranspired

Menor WP, porque es mayor el incremento de la ET respecto al del rendimiento.

2º alternativa de riego

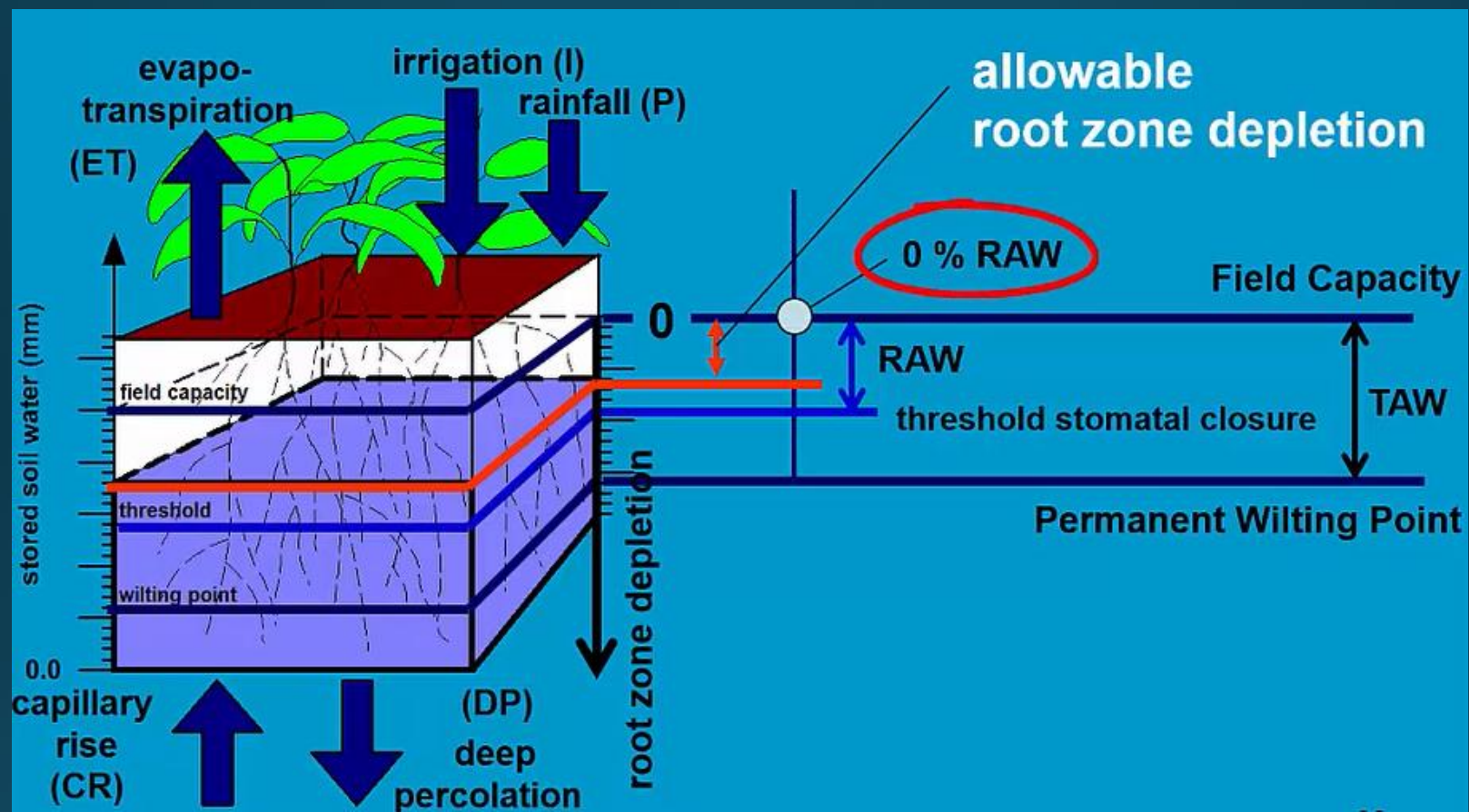


- Dejar solamente 1 riego al inicio de la temporada (día 15)

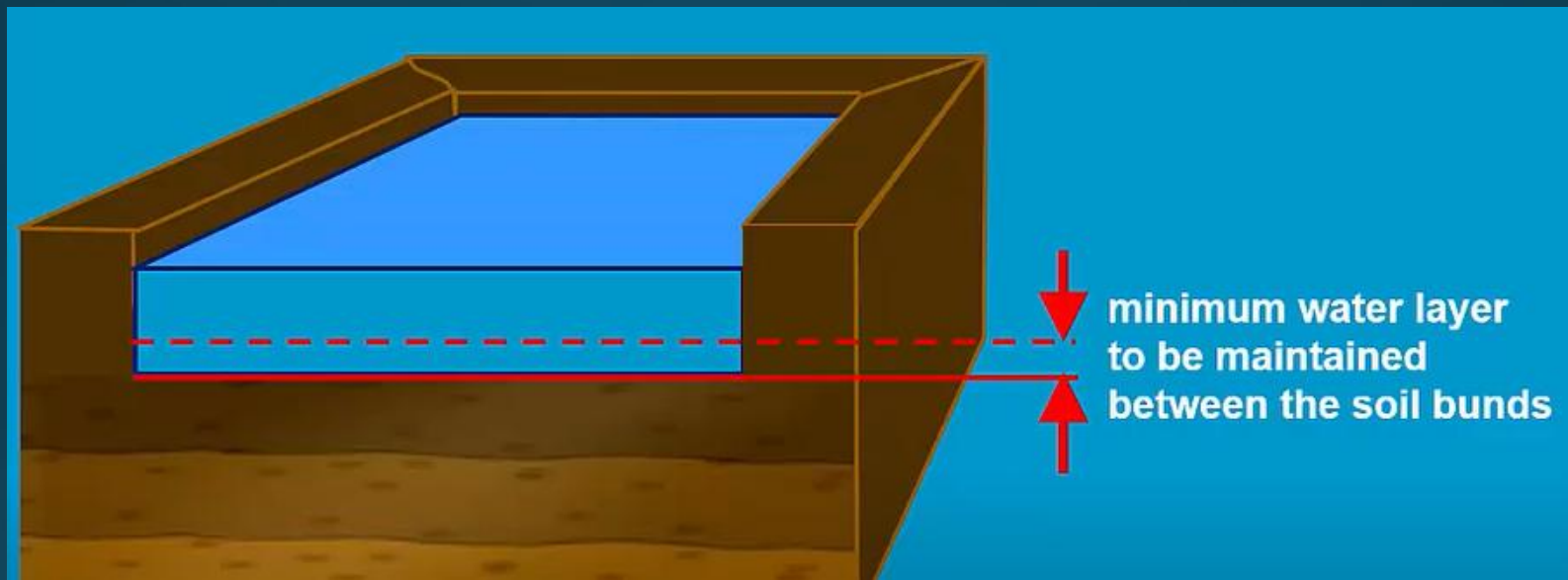
	Evaluated schedule	1 st update	2 nd update
Biomass [ton/ha]	<u>14.3</u>	15.4	<u>14.3</u>
Dry yield [ton/ha]	<u>7.5</u>	7.7	<u>7.5</u>
Irrigation [mm]	525	525	425
WP_{ET} [kg/m ³]	1.44	1.37	1.48
Harvest Index [%]	<u>52.5</u>	50.2	<u>52.5</u>

CRITERIOS PARA PROGRAMAR EL RIEGO

	CRITERIO	PARAMETRO
CUANDO?	AGOTAMIENTO ADMISIBLE	Regar cuando se alcanza un umbral específico (mm o % de RAW)
	LÁMINA DE AGUA ENTRE BORDOS	Lámina de agua a mantener por encima de un determinado valor
	INTERVALO FIJOS (DIAS)	Regar cada un cierto periodo de tiempo (puede ser variable a lo largo de la temporada)
CUANTO?	HASTA CAPACIDAD DE CAMPO	Cantidad agua extra necesaria para lograr que la zona radical esté encapacidad de campo
	LÁMINA FIJA DE RIEGO	Seleccionada en función del método de riego, tipo de suelo y cultivo

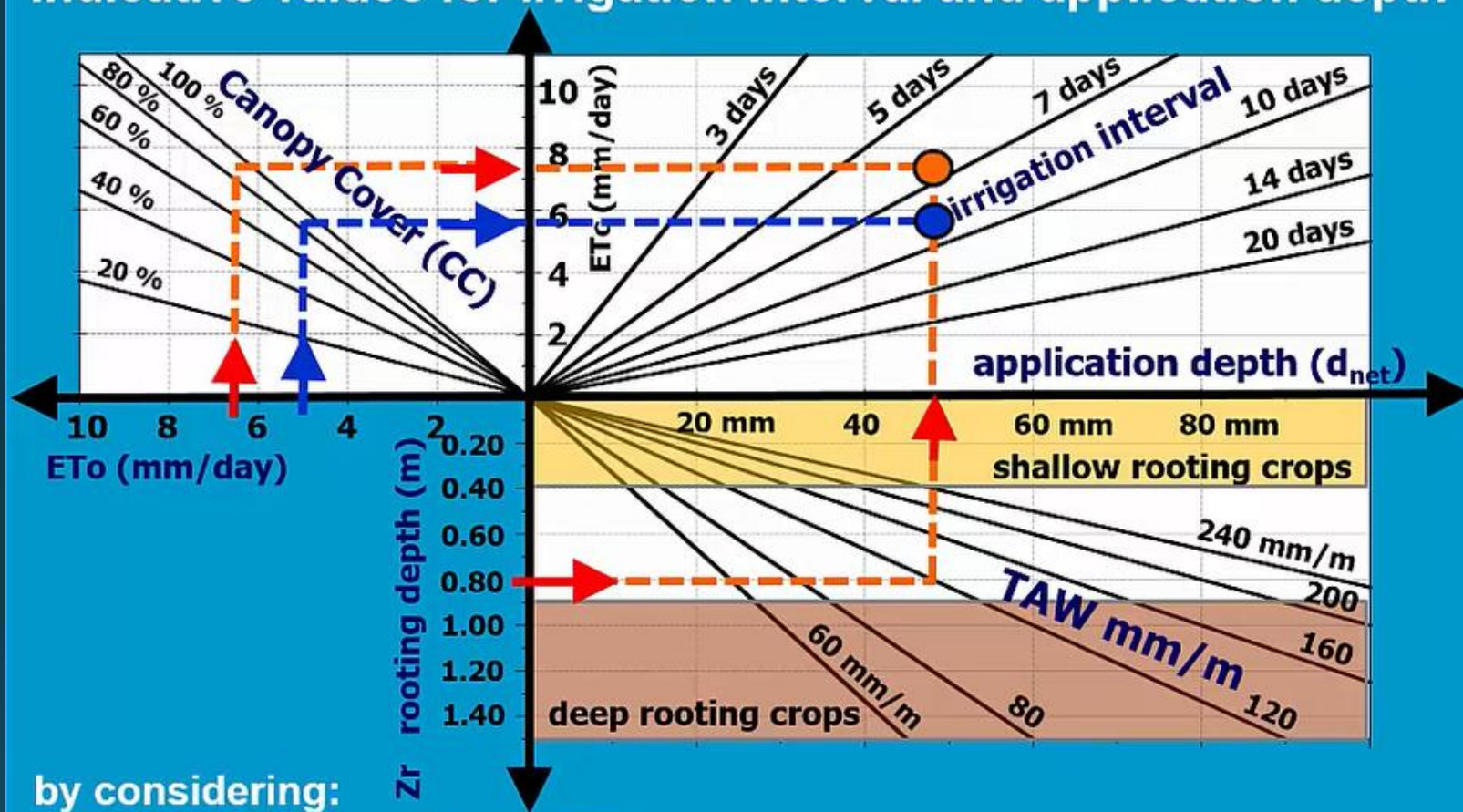


AGOTAMIENTO ADMISIBLE




LAMINA DE AGUA ENTRE BORDOS

Indicative values for irrigation interval and application depth



by considering:

- The weather conditions (ETo)
- Crop canopy cover (CC)
- Rooting depth (Zr)
- Soil physical characteristics (TAW)

Irrigation method		Application depth [mm]
Surface	<input type="checkbox"/> Basin	50 – 150
	<input type="checkbox"/> Border	40 – 80
	<input type="checkbox"/> Furrow	30 – 60
Sprinkler	<input type="checkbox"/> Solid set	30 – 80
	<input type="checkbox"/> Center pivot, linear move, travelling gun (if infiltration allows) 	15 – 35 (up to 80)
Localized	Drip, micro-sprinkler, ...	5 – 25

Fuente: Aquacrop-Training module, FAO (2016)

Soil textural class	TAW [mm/m]	
	mean	range
Sand	70	55 – 75
Loamy sand	80	65 – 85
Sandy loam	120	110 – 130
Loam	160	155 – 185
Silt loam	200	170 – 225
Silt	240	225 – 250
Sandy clay loam	120	90 – 135
Clay loam	160	145 – 175
Silty clay loam	210	195 – 215
Sandy clay	120	100 – 125
Silty clay	180	175 – 190
Clay	150	135 – 160

Fuente: Aquacrop Training module, FAO (2016)

Tomate regado por surcos

1º Programa de riego

Generation of irrigation schedule

Mode | Irrigation method | Time and Depth criteria

Time and depth criteria

soil bunds

Time Criteria

- ☐ Fixed interval
- ☐ Allowable depletion (mm water)
- ☒ Allowable depletion (% of RAW)
- ☐ Water layer between bunds

Depth Criteria

- ☐ Back to Field Capacity
- ☒ Fixed net application

Irrigation water quality

EC_w dS/m

assign

Day No. 1 - day 1 after planting: 1 April 2000

valid From

When ?

Depth ?

Quality

Date	Day No.	Depleted % RAW	Depth (mm)	dS/m
1 April 2000	1	40	30	0.0

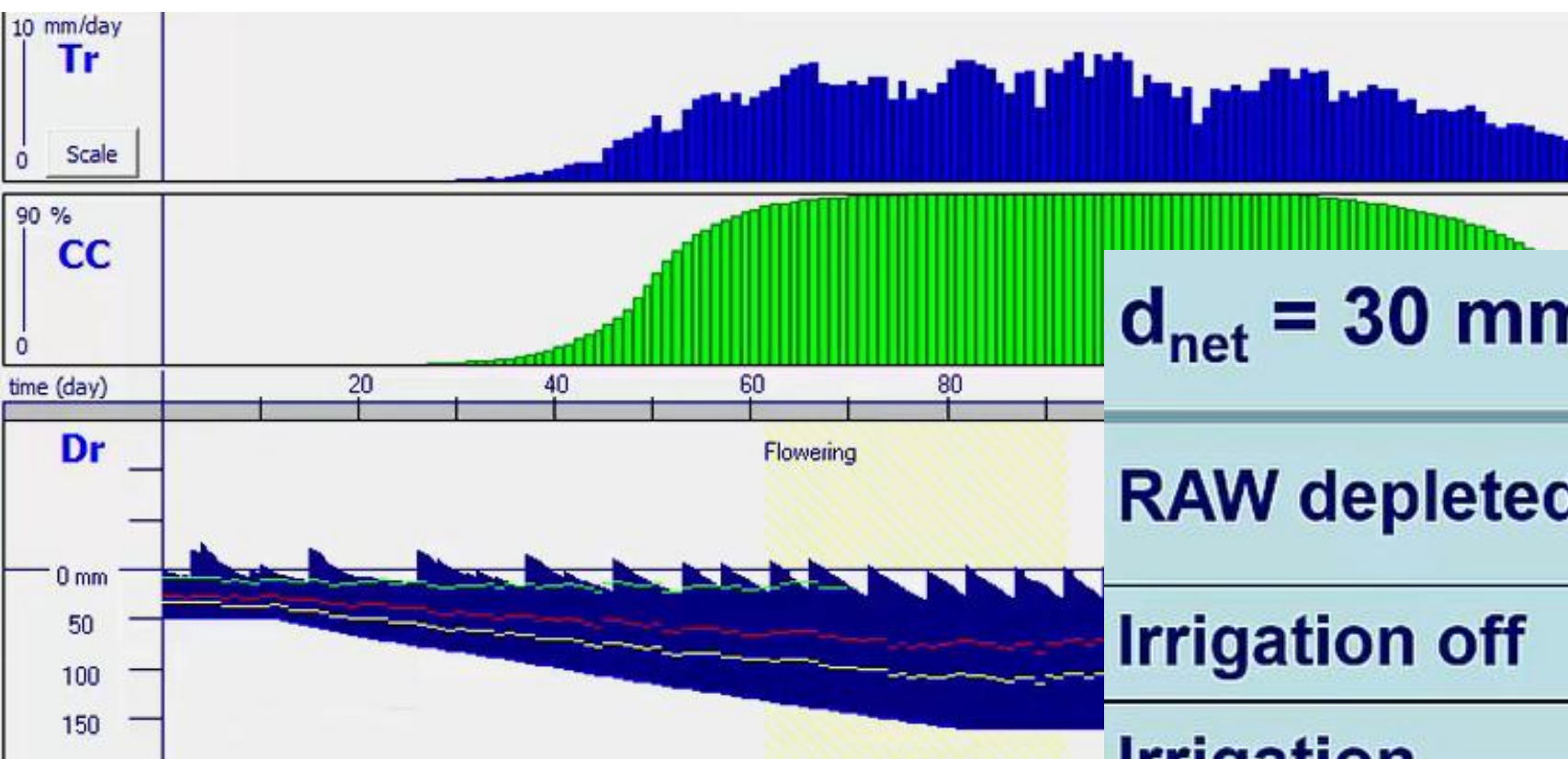
Growing cycle

Canopy Cover

Thresholds

Day No. 145 - maturity: 23 August 2000

Clear All Events



$d_{\text{net}} = 30 \text{ mm}$

Full
irrigation

RAW depleted (%)

40

Irrigation off

15 August

Irrigation

- amount (mm)

600

- events (number)

20

Yield (ton/ha)

10.0

WP_{ET} (kg/m³)

1.46

2º Programa de riego bajo un periodo de escasez hídrica

Mode | Irrigation method | Time and Depth criteria

Time and depth criteria

soil bunds

Time Criteria

- ☐ Fixed interval
- ☐ Allowable depletion (mm water)
- ☒ Allowable depletion (% of RAW)
- ☐ Water layer between bunds

Depth Criteria

- ☐ Back to Field Capacity
- ☒ Fixed net application

Irrigation water quality

EC_w dS/m


assign

Day No. 1 - day 1 after planting: 1 April 2000

valid From **When ?** **Depth ?** **Quality**

Date	Day No.	Depleted % RAW	Depth (mm)	dS/m
1 April 2000	1	100	30	0.0
15 August 2000	137	500	0	0.0

Growing cycle



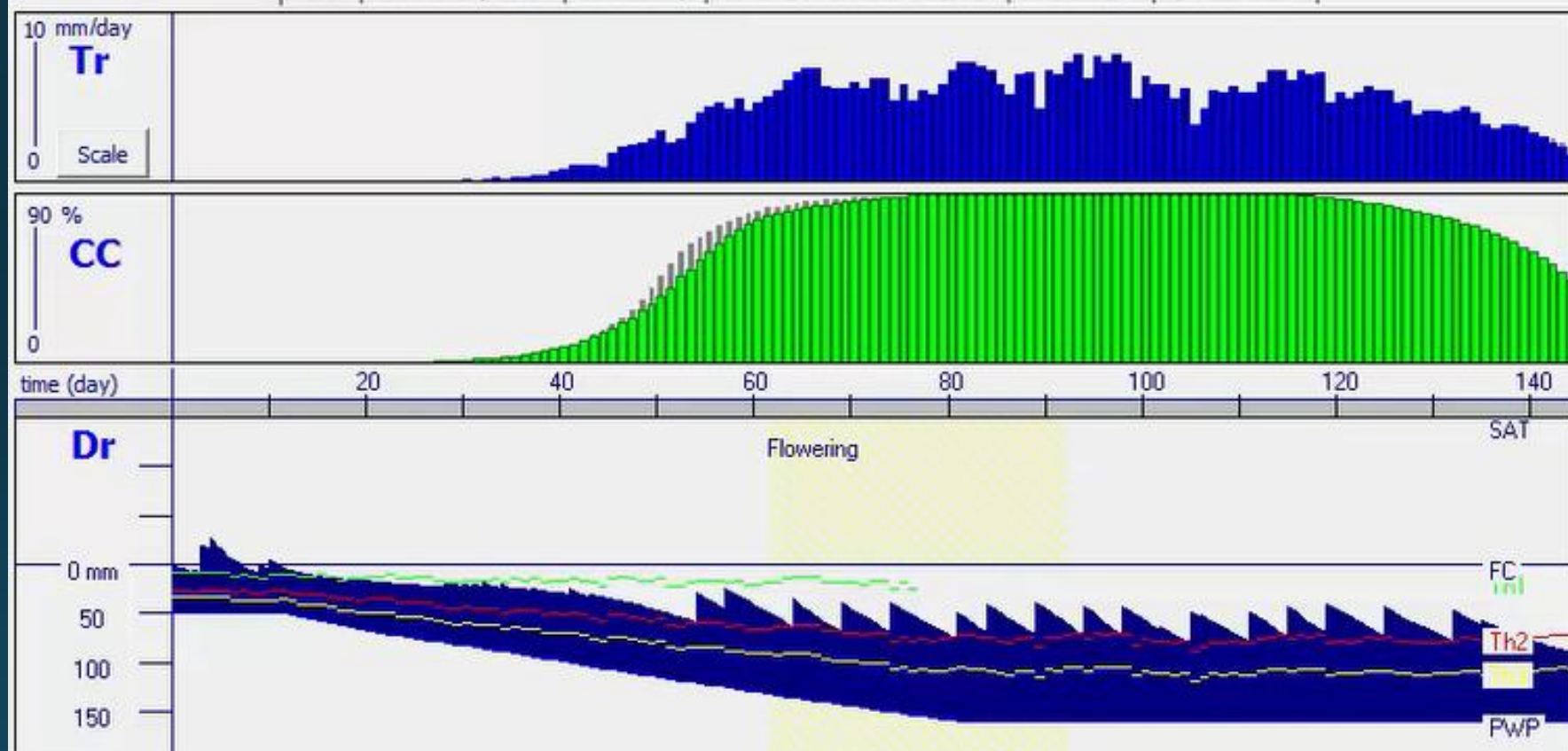
Canopy Cover

Thresholds

Day No. 145 - maturity: 23 August 2000

Clear All Events

soil salinity.....	none	none
temperature (Biomass).....	none	none
water stresses		
canopy expansion.....	X	10 %
stomatal closure.....	15 %	none
early senescence	none	
soil fertility.....		none
weed infestation.....		none



$d_{\text{net}} = 30 \text{ mm}$	Full irrigation	Alternative strategies saving water		saved
RAW depleted (%)	40	100		
Irrigation off	15 August			
Irrigation	reference	25%		
- amount (mm)	600	450		
- events (number)	20	15		
Yield (ton/ha)	10.0	9.8		
WP_{ET} (kg/m ³)	1.46	1.56		

Fuente: Aquacrop-Training module, FAO (2016)

3° Programa de riego bajo un periodo de escasez hídrica post floración

Time and depth criteria

☐ soil bunds

Time Criteria

- ☐ Fixed interval
- ☐ Allowable depletion (mm water)
- ☒ Allowable depletion (% of RAW)
- ☐ Water layer between bunds

Depth Criteria

- ☐ Back to Field Capacity
- ☒ Fixed net application

Irrigation water quality


EC_w dS/m

Day No. 1 - day 1 after planting: 1 April 2000

valid From **When ?** **Depth ?** **Quality**

Date	Day No.	Depleted % RAW	Depth (mm)	dS/m
1 April 2000	1	100	30	0.0
1 July 2000	92	130	30	0.0
15 August 2000	137	500	0	0.0

Growing cycle



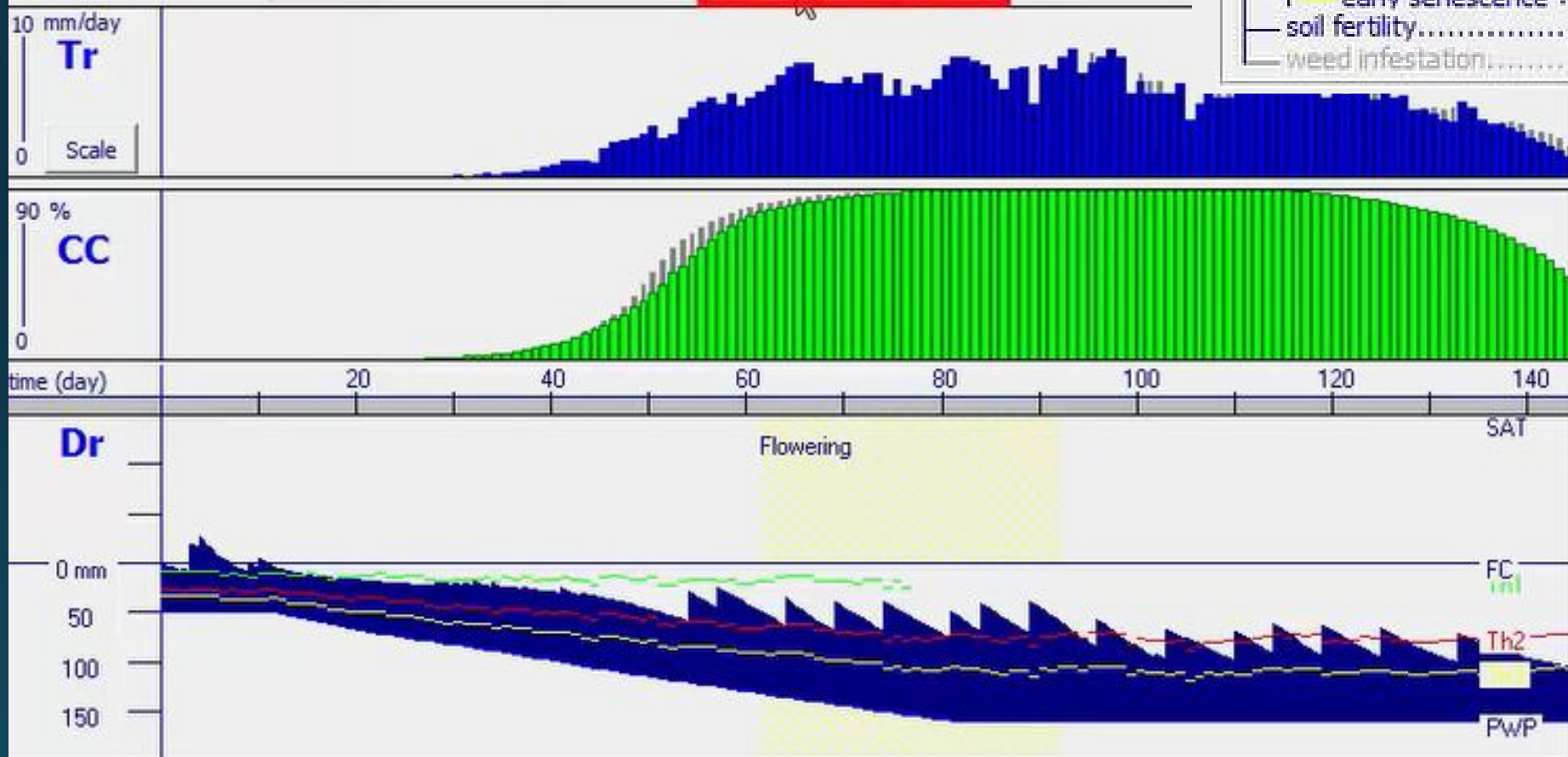
Canopy Cover

Thresholds

Day No. 145 - maturity: 23 August 2000

Stresses

		average crop cycle
soil salinity.....	none	none ..
temperature (Biomass).....	none	none ..
water stresses ———		
— canopy expansion.....	X	10 % ..
— stomatal closure.....	33 %	3 % ..
— early senescence	none	
soil fertility.....		none ..
weed infestation.....		none ..



$d_{\text{net}} = 30 \text{ mm}$	Full irrigation	Alternative strategies saving water			saved
RAW depleted (%)	40	100	100	130 (at 1 July)	
Irrigation off	15 August				
Irrigation	reference	25%	30%		
- amount (mm)	600	450	420		
- events (number)	20	15	14		
Yield (ton/ha)	10.0	9.8	9.5		
WP_{ET} (kg/m ³)	1.46	1.56	1.55		

4° Programa de riego: reducir la cantidad de agua aplicar durante la maduración

Cortar el riego 15 días antes

Time and depth criteria

soil bunds

Time Criteria

- ☐ Fixed interval
- ☐ Allowable depletion (mm water)
- ☒ Allowable depletion (% of RAW)
- ☐ Water layer between bunds

Depth Criteria

- ☐ Back to Field Capacity
- ☒ Fixed net application

Irrigation water quality

EC_w 0.0 dS/m

assign

Day No. 1 - day 1 after planting: 1 April 2000

valid From

Date	Day No.	When ? Depleted % RAW	Depth ? Depth (mm)	Quality dS/m
1 April 2000	1	100	30	0.0
1 July 2000	92	130	30	0.0
1 August 2000	123	500	0	0.0

Growing cycle

Canopy Cover
















Thresholds

Day No. 145 - maturity: 23 August 2000

Clear All Events

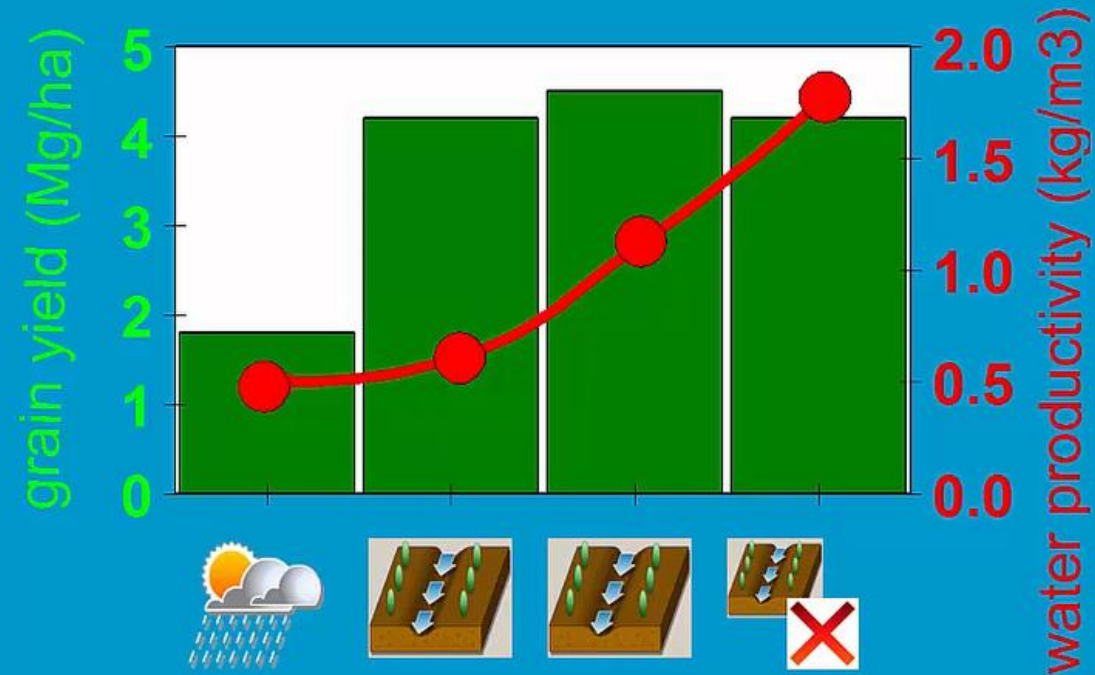
40 % de ahorro de agua para el riego del cultivo
10% de disminución del rendimiento

$d_{\text{net}} = 30 \text{ mm}$	Full irrigation	Alternative strategies saving water		
RAW depleted (%)	40	100	(at 1 July)	100 130
Irrigation off	15 August			1 Aug
Irrigation	reference	25%	30%	40%
- amount (mm)	600	450	420	360
- events (number)	20	15	14	12
Yield (ton/ha)	10.0	9.8	9.5	9.0
WP_{ET} (kg/m ³)	1.46	1.56	1.55	1.54
for each 6,000 m ³ available irrigation water				
Irrigated area	1 ha	(6,000/3,600 =)		1.67 ha
Dry yield	10 ton	(1.67 x 9 =)		15 ton
50 % yield increase				

	rainfall	irrigation				ton/ha
rainfed						2
irrigation						5
deficit irrigation						4

En riegos deficitarios, se riega en los periodos de mayor sensibilidad al estrés hídrico.

ET water productivity (WP_{ET})



**Irrigation
strategy**

none

-

local
2.980

guidelines
2.220

deficit
1.110 m³/hectare

Source IWMI. annual report 2002-2003