MANEJO DEL RIEGO

M Sc Ing. Rocío Hernández

M Sc Ing. Leandro Martin

UNIVERSIDAD NACIONAL DE CUYO

MENDOZA - ARGENTINA

superficie del suelo

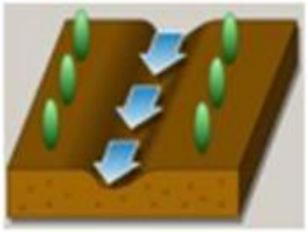
Manejo

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 secano 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

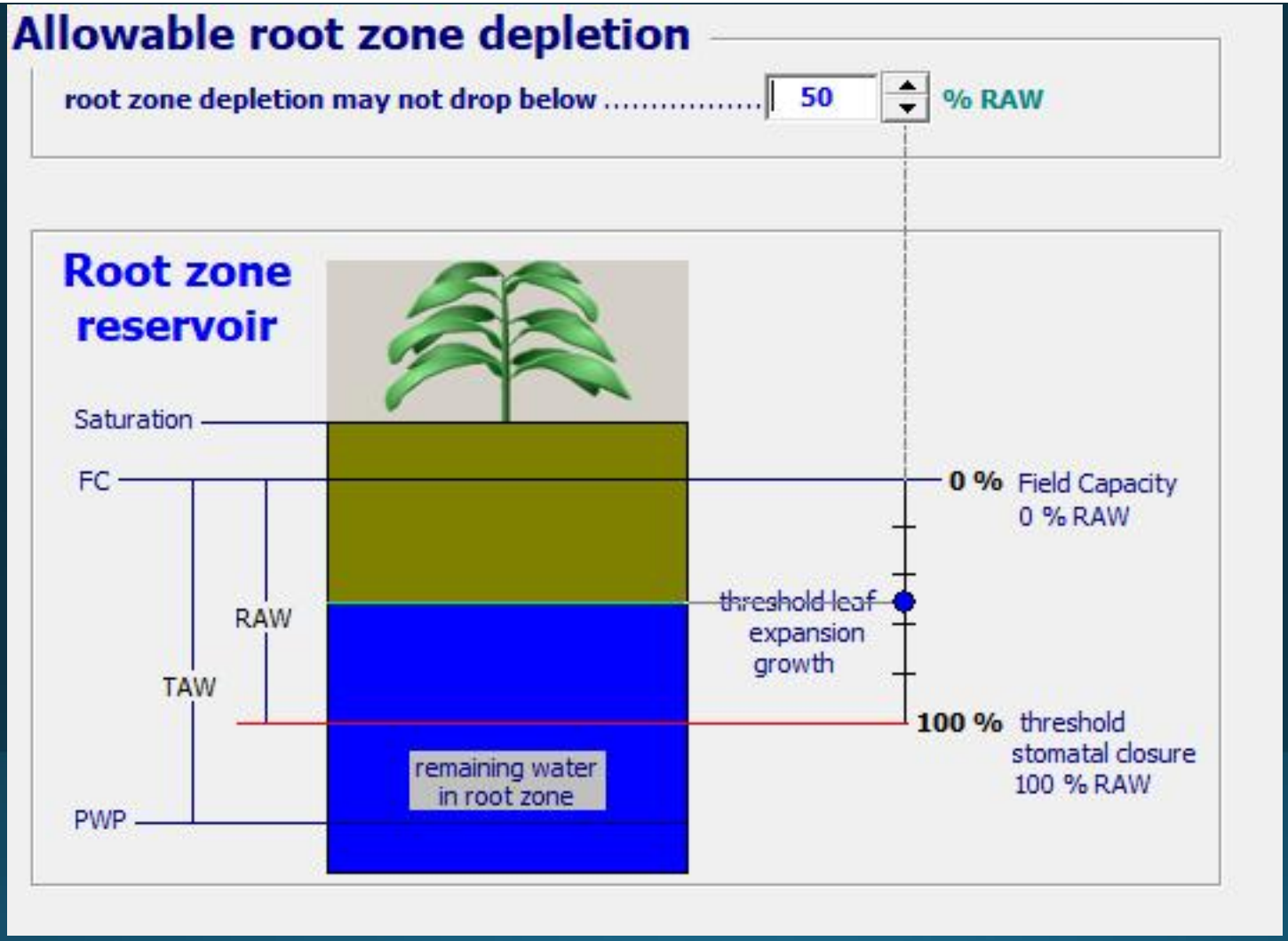
when
irrigation applications…….
quantity
quality (salt content)

Fuente: Aquacrop-Training module, FAO (2016)

Necesidades o requerimientos netos de riego

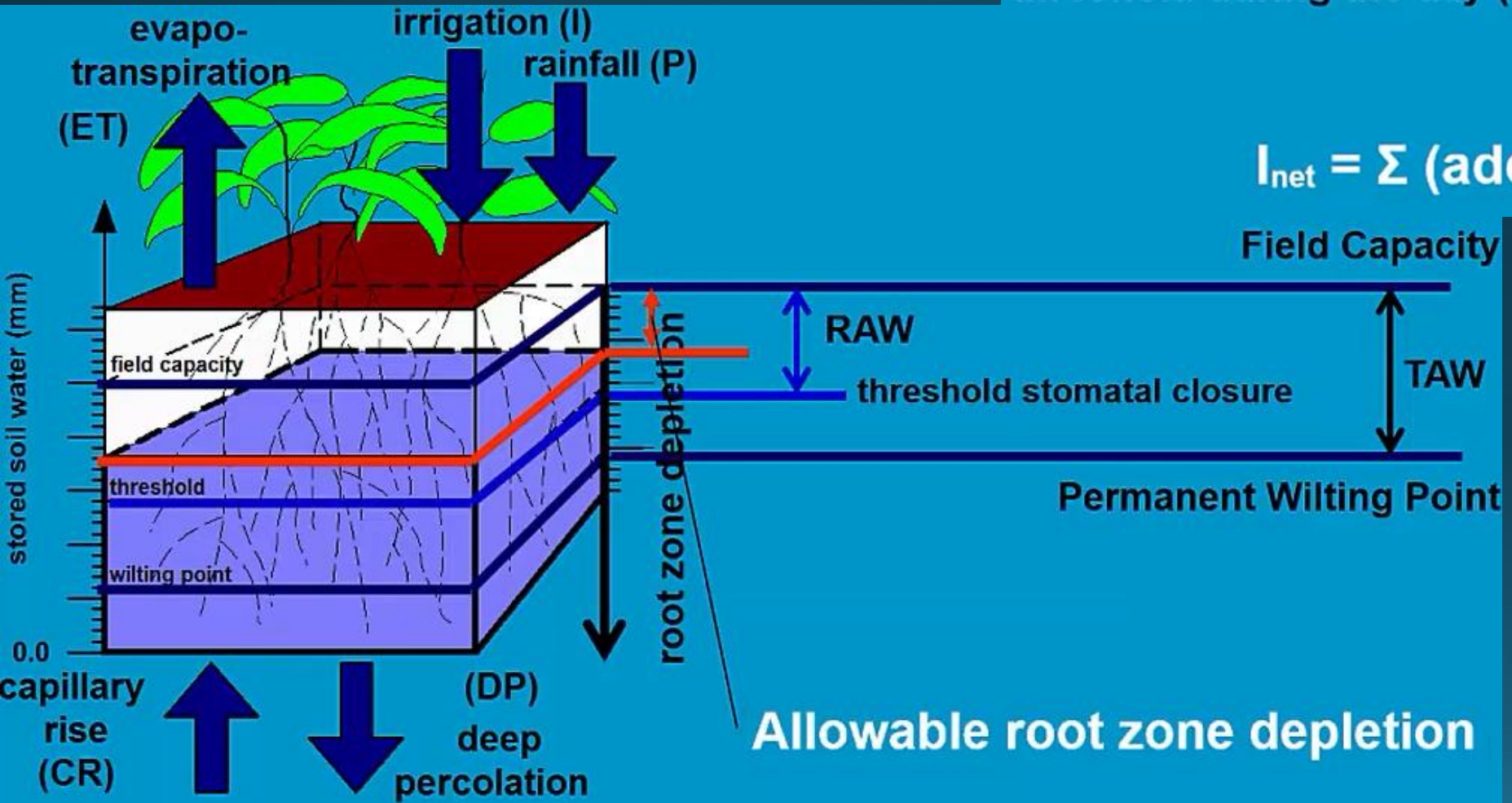
$$Nn = ETc - Ppef$$

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.



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)



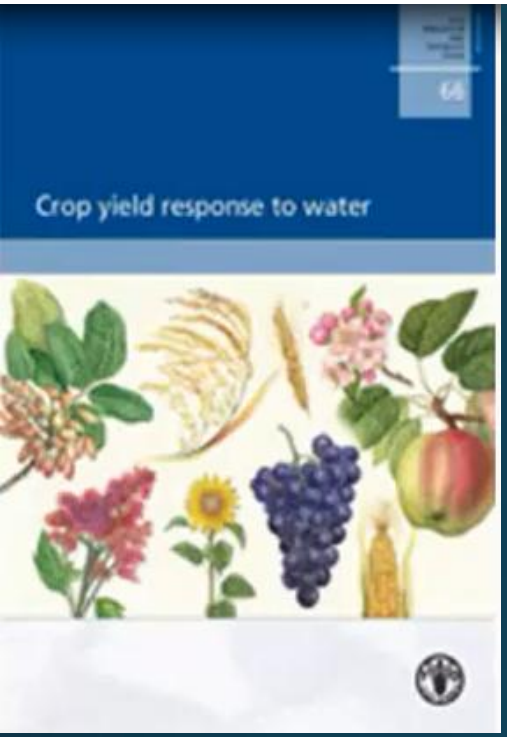
$I_{net} = \Sigma$ (added water)

Fuente: Aquacrop-Training module, FAO (2016)

SIMULACIÓN AQUACROP

TOMATE: Clima Valenzano
Suelo Silty clay
Fecha de transplante: 1/10

Secano y con riego

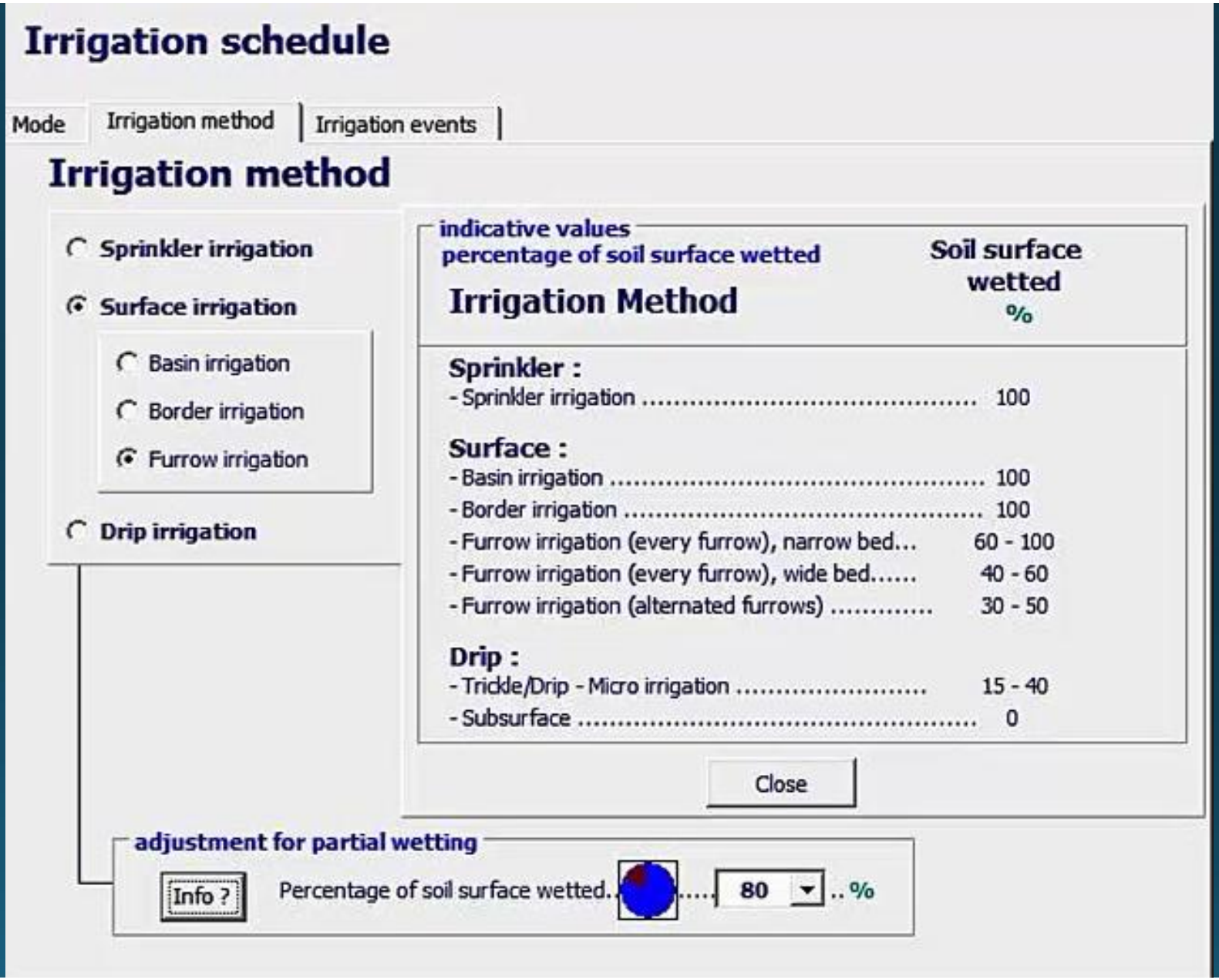


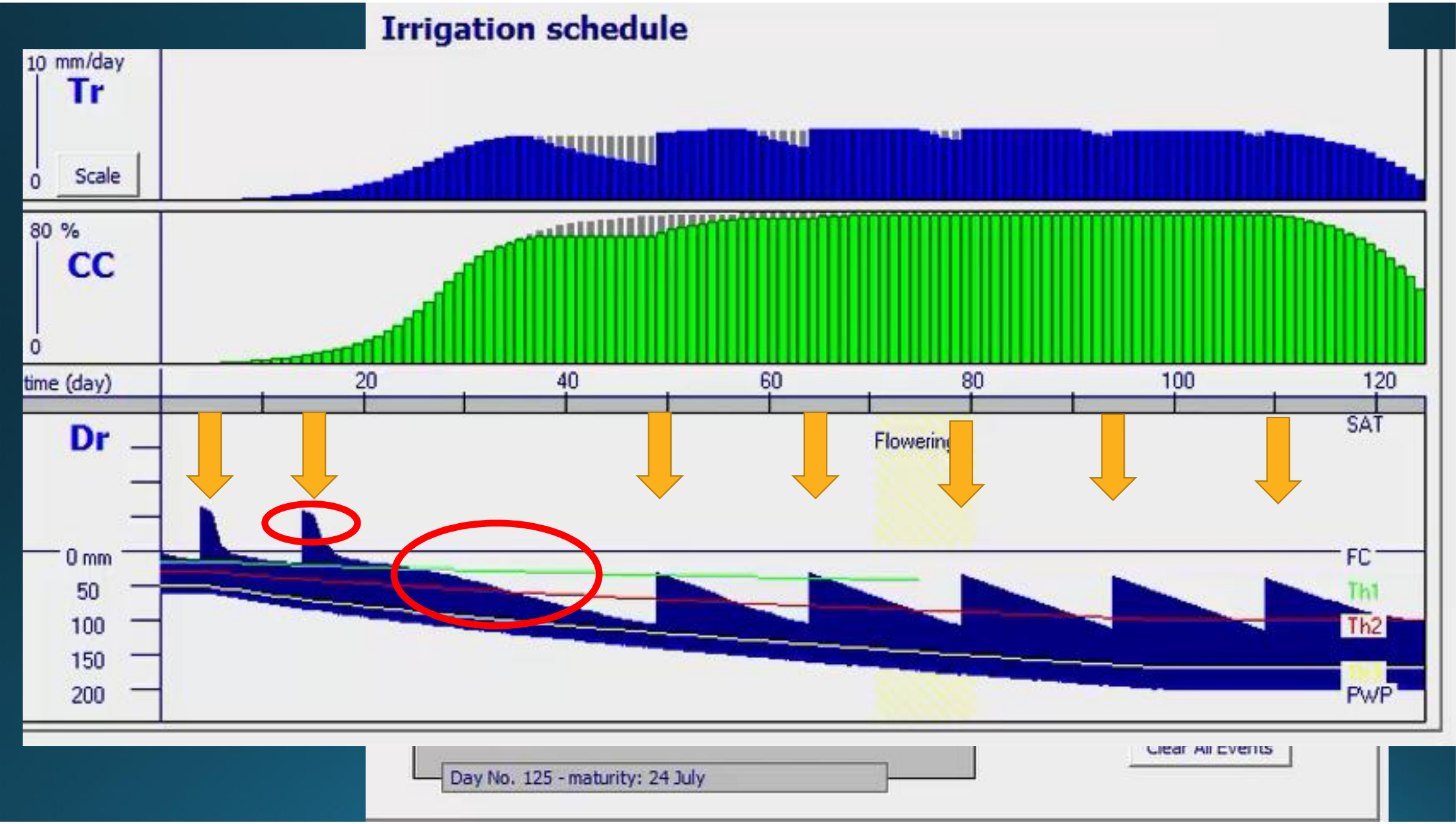
Tomato ..... page 192 - 198
Dry matter content of fresh fruit ranges from 4.0 to 7.0 percent

Dry yield ≈ 10 ton per hectare

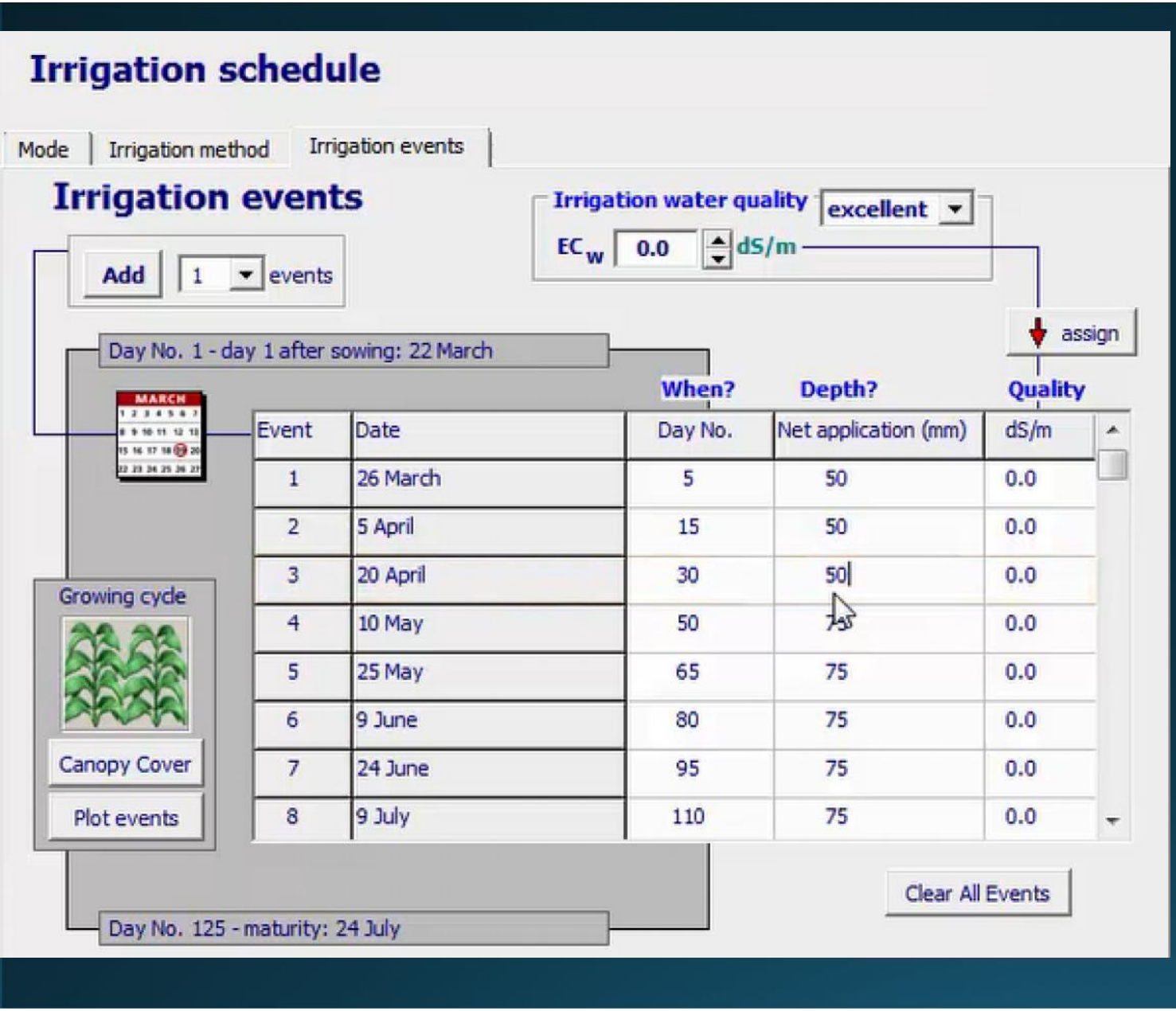
Fresh yield ≈ 10/0.070 ≈ 145 ton per hectare

PROGRAMA DE RIEGO




Irrigation schedule
10 mm/day
Tr
0
Scale
80 %
CC
0
time (day)
20
40
60
80
100
120
Dr
SAT
Flowering
0 mm
50
100
150
200
FC
Th1
Th2
PWP
Day No. 125 - maturity: 24 July

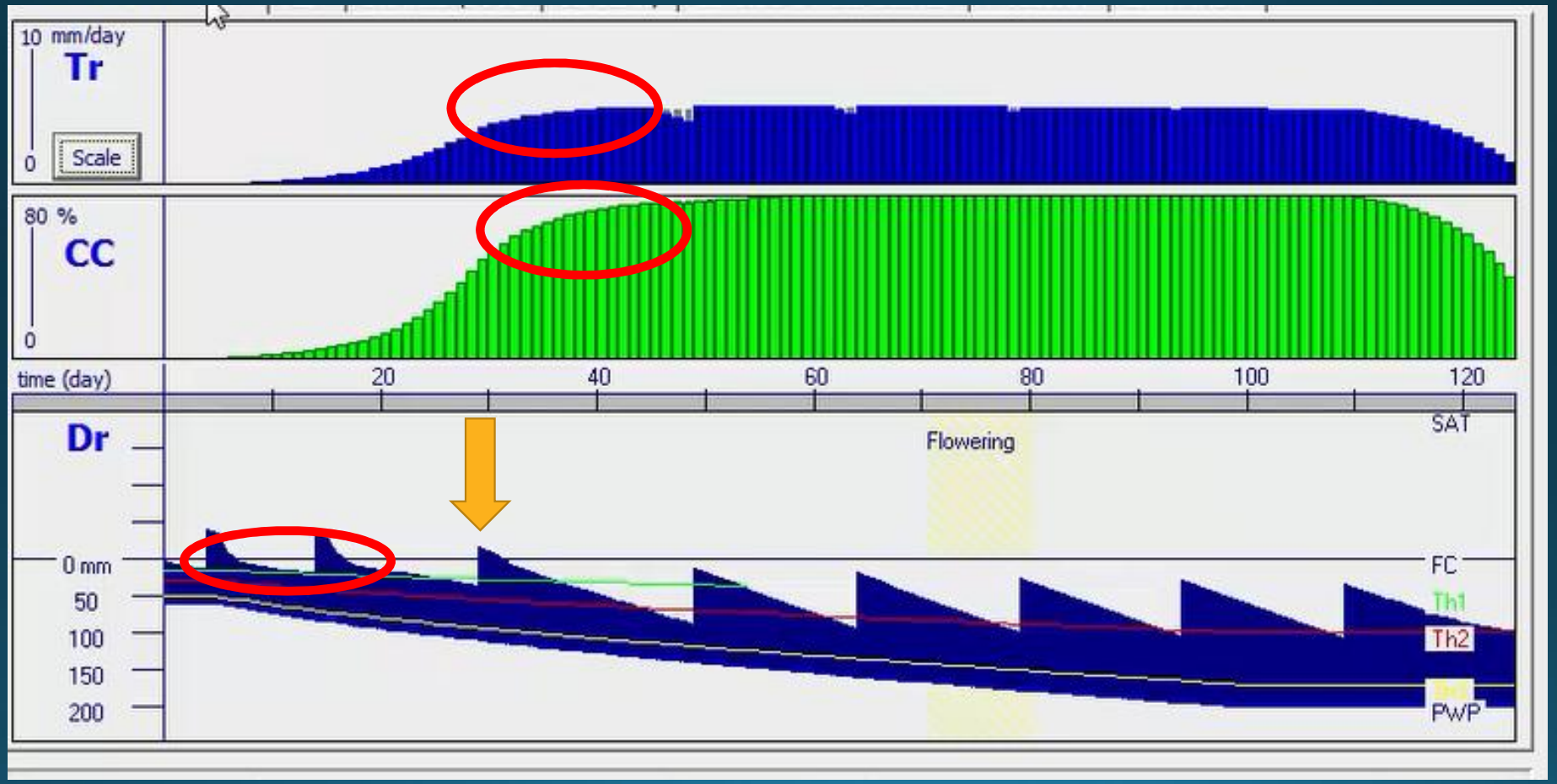
	Evaluated schedule		
Biomass [ton/ha]	14.3		
Dry yield [ton/ha]	7.5		
Irrigation [mm]	525		
WP_{ET} [kg/m^3]	1.44		
Harvest Index [%]	52.5		



Nuevo programa de riego

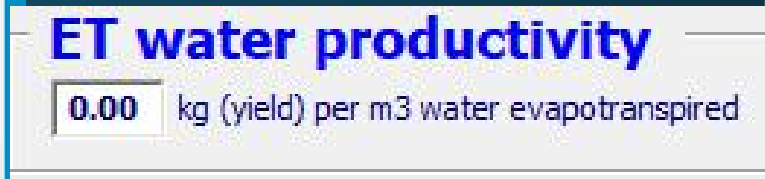
- **Reducir láminas de riego en días 5 y 15**
- **Agregar un riego en el día 30.**

1° alternativa de riego



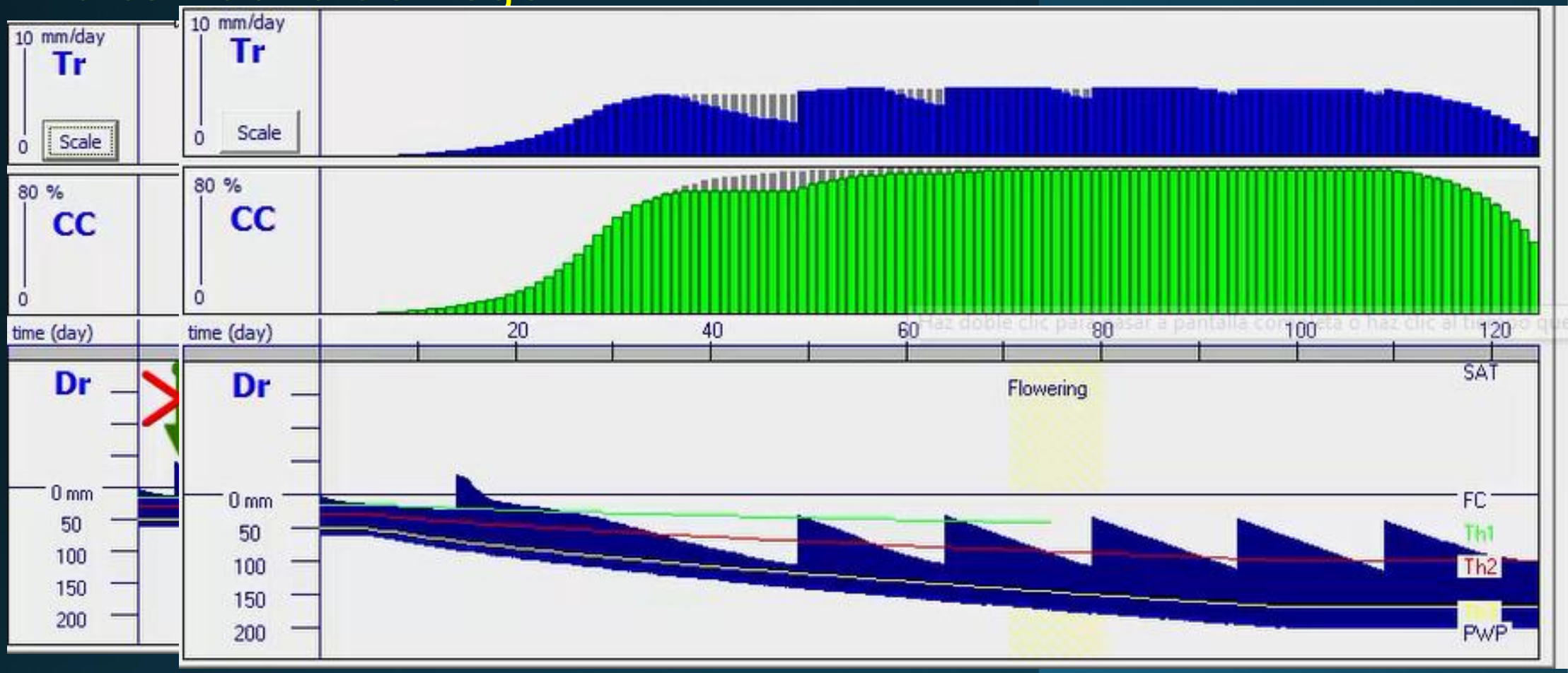
	Evaluated schedule	1st update	
Biomass [ton/ha]	14.3	15.4	
Dry yield [ton/ha]	7.5	7.7	
Irrigation [mm]	525	525	
WP_{ET} [kg/m³]	1.44	1.37	
Harvest Index [%]	52.5	50.2	

Leve incremento del rendimiento



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

2° alternativa de riego

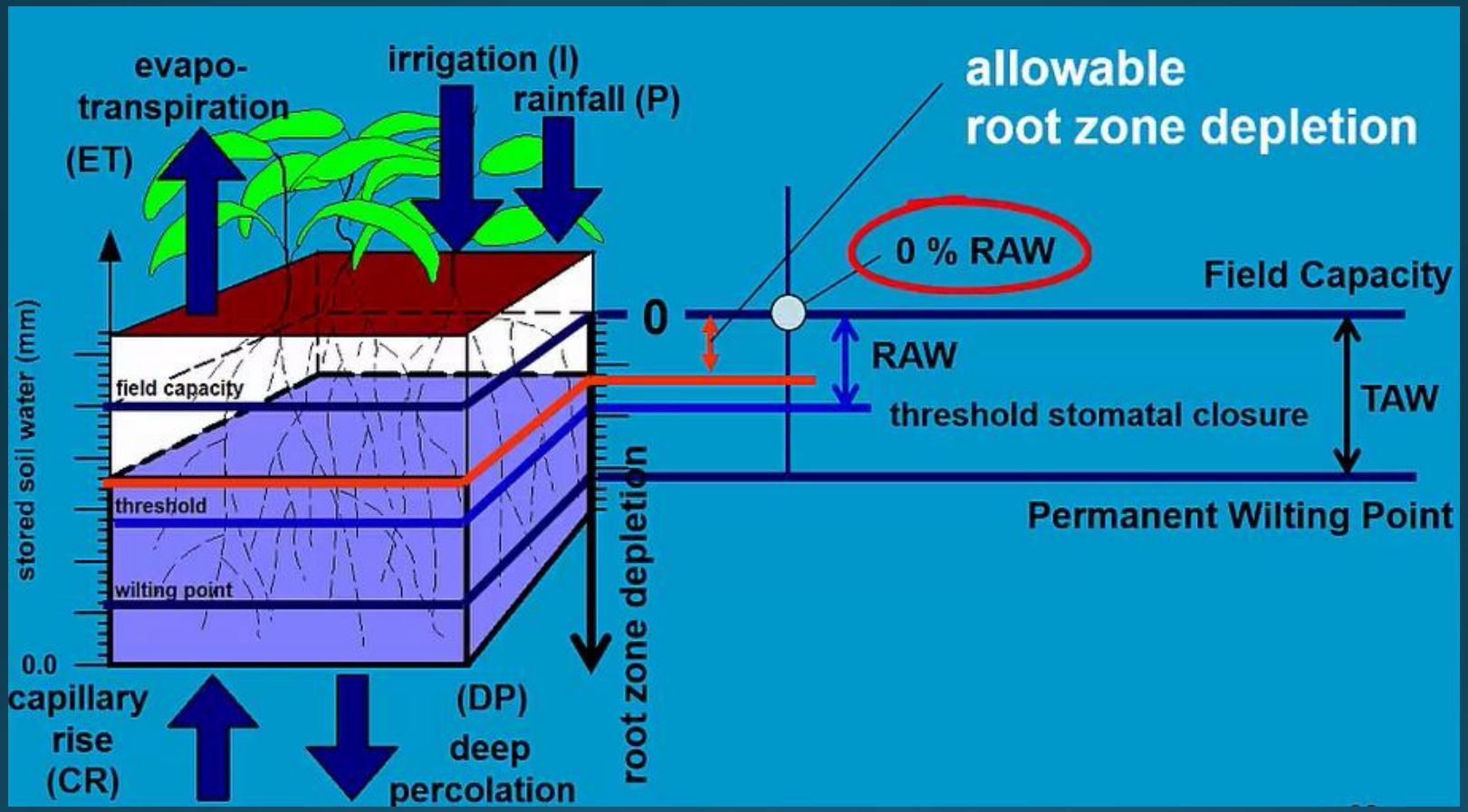


- Dejar solamente 1 riego al inicio de la temporada (día 15)

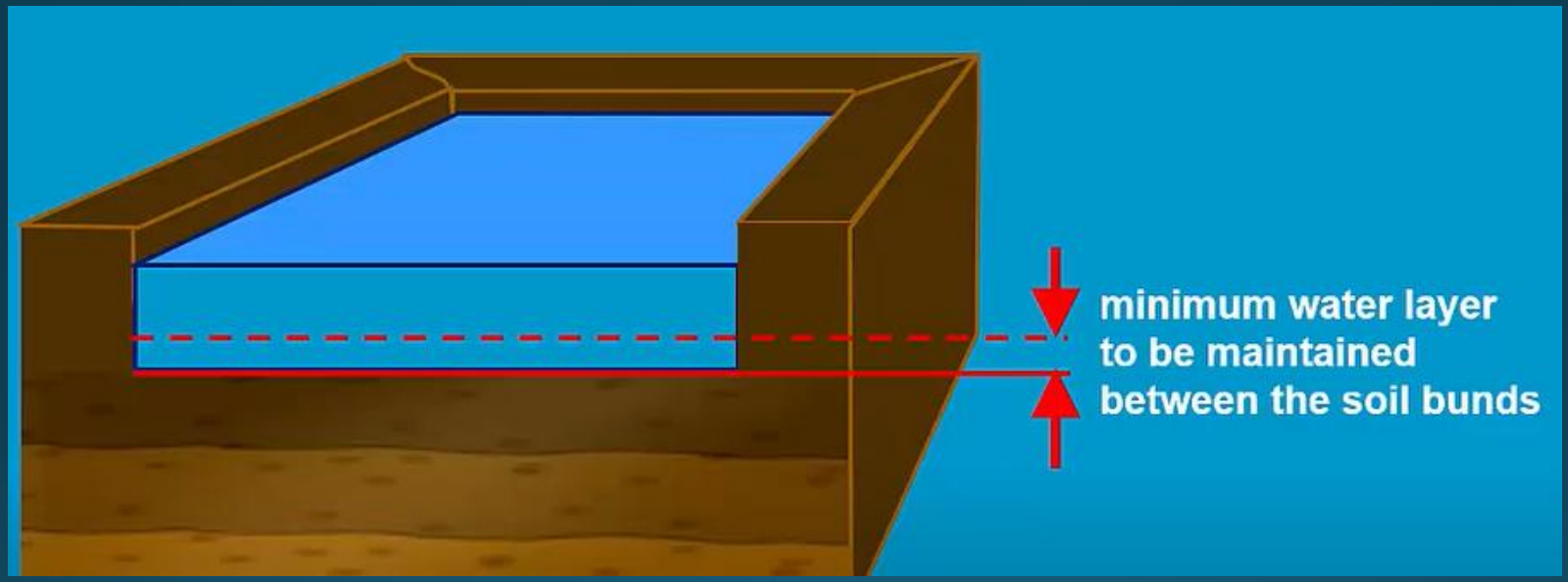
	Evaluated schedule	1st update	2nd update
Biomass [ton/ha]	14.3	15.4	14.3
Dry yield [ton/ha]	7.5	7.7	7.5
Irrigation [mm]	525	525	425
WP_{ET} [kg/m^3]	1.44	1.37	1.48
Harvest Index [%]	52.5	50.2	52.5

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

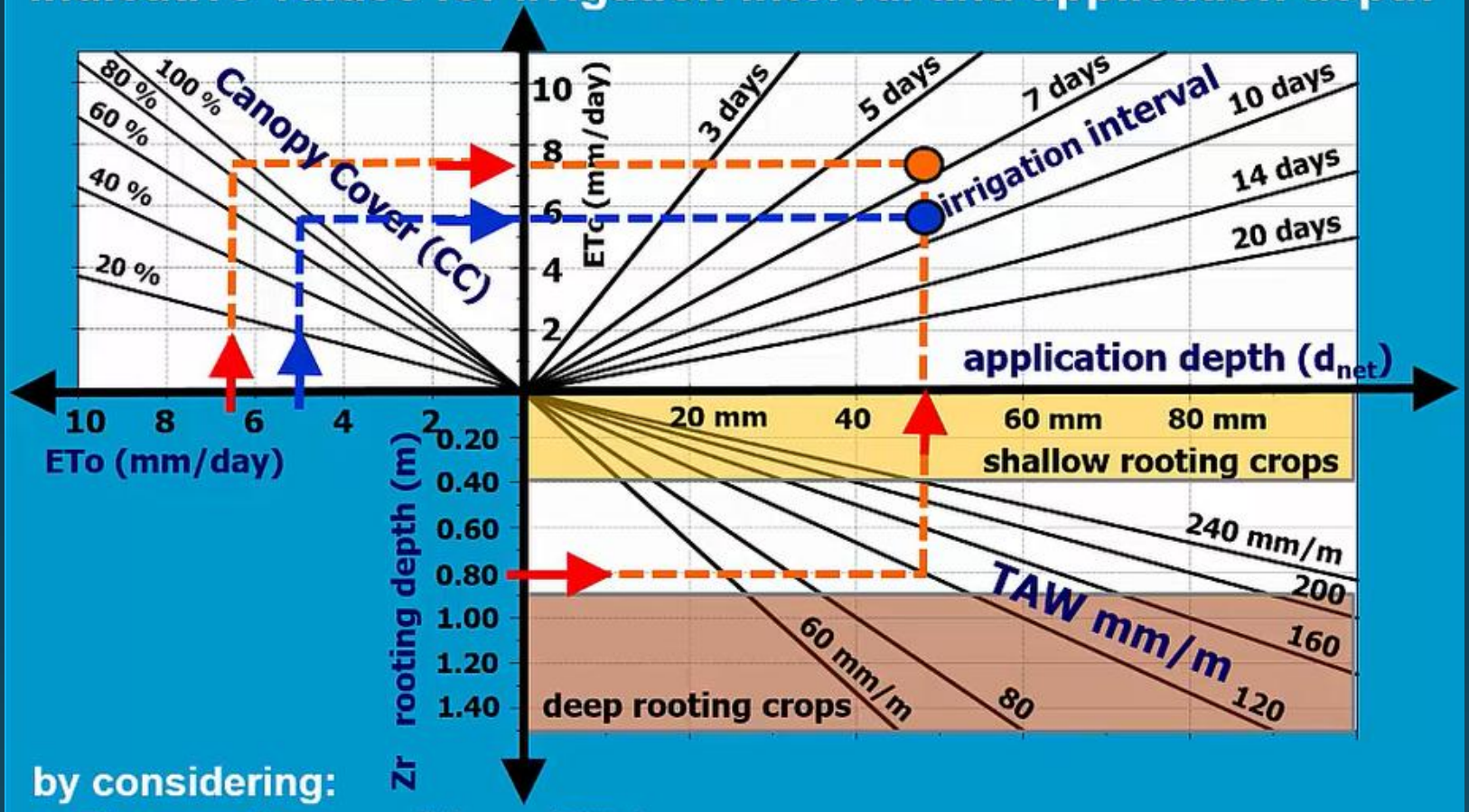


AGOTAMIENTO ADMISIBLE



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)

Fuente: Aquacrop- Training module, FAO (2016)

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

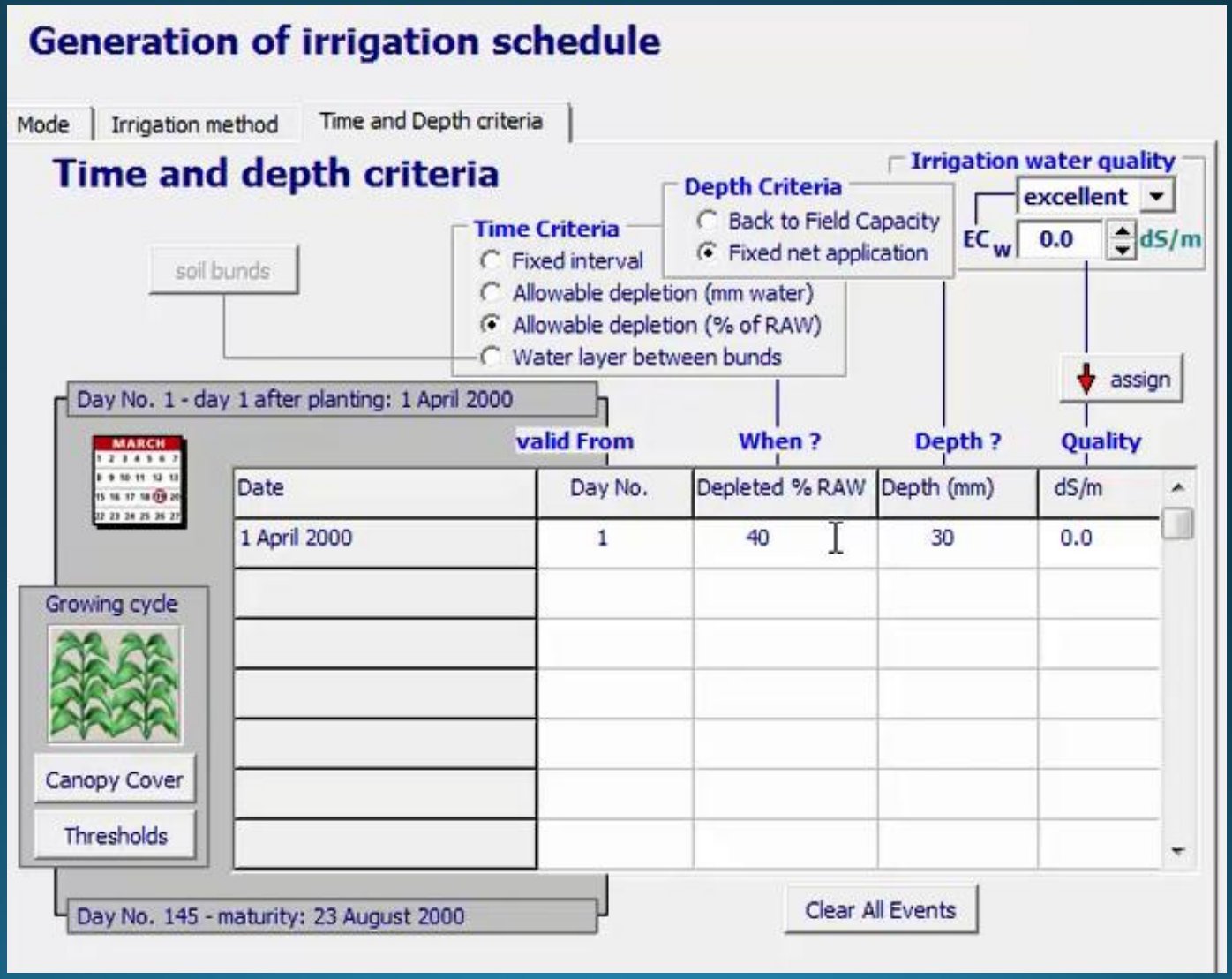
Fuente: Aquacrop-Training module, FAO (2016)

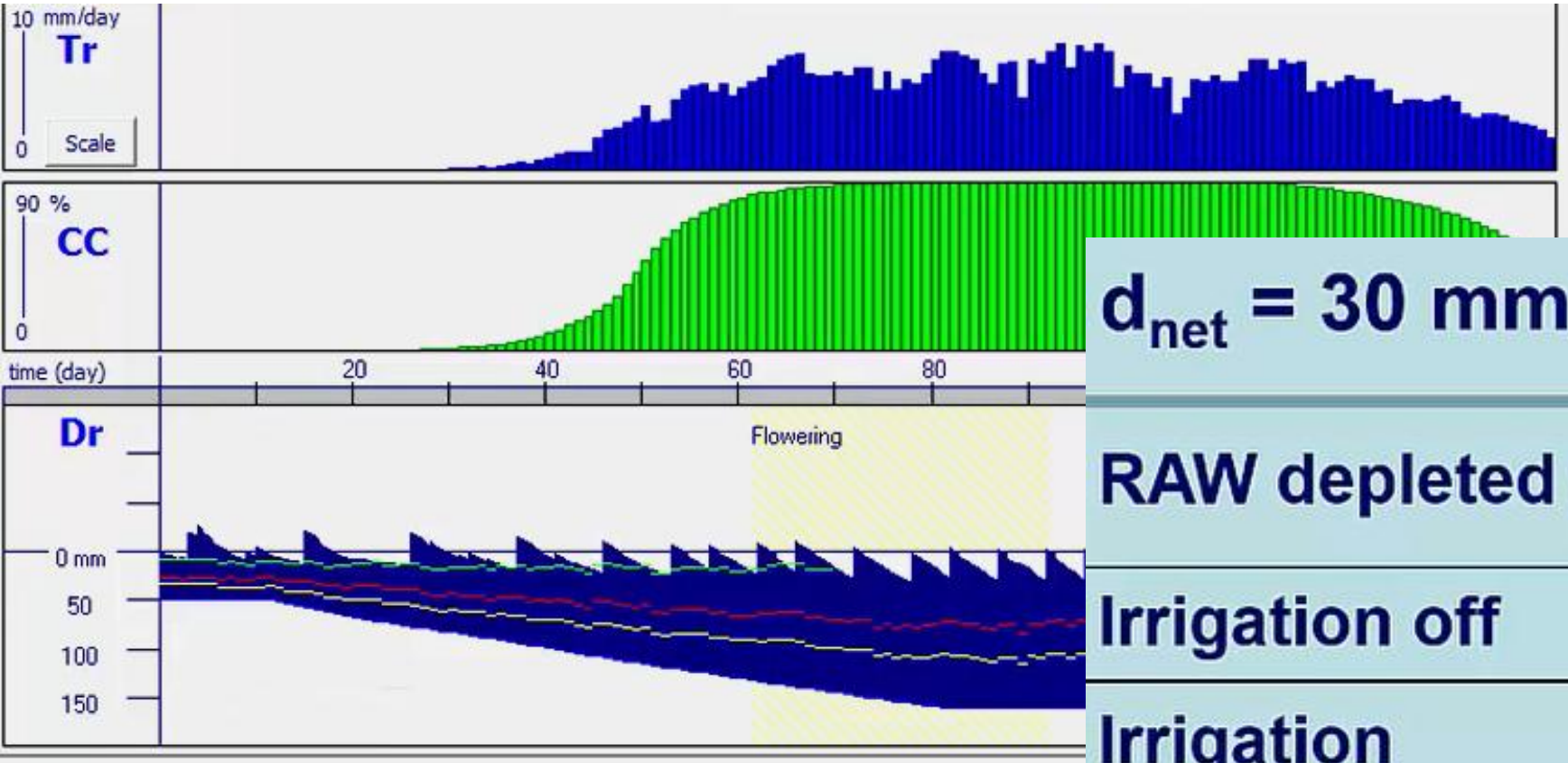
Soil textural class	TAW [mm/m]	
	mean	range
Sand	70	55 – 75
Loamy sand	80	65 – 85
Sandy loam	120	110 – 130
Loam	160	155 – 185
Silt loam	200	170 – 225
Silt	240	225 – 250
Sandy clay loam	120	90 – 135
Clay loam	160	145 – 175
Silty clay loam	210	195 – 215
Sandy clay	120	100 – 125
Silty clay	180	175 – 190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

Fuente: AquaCrop Training module, FAO (2016)

Tomate regado por surcos

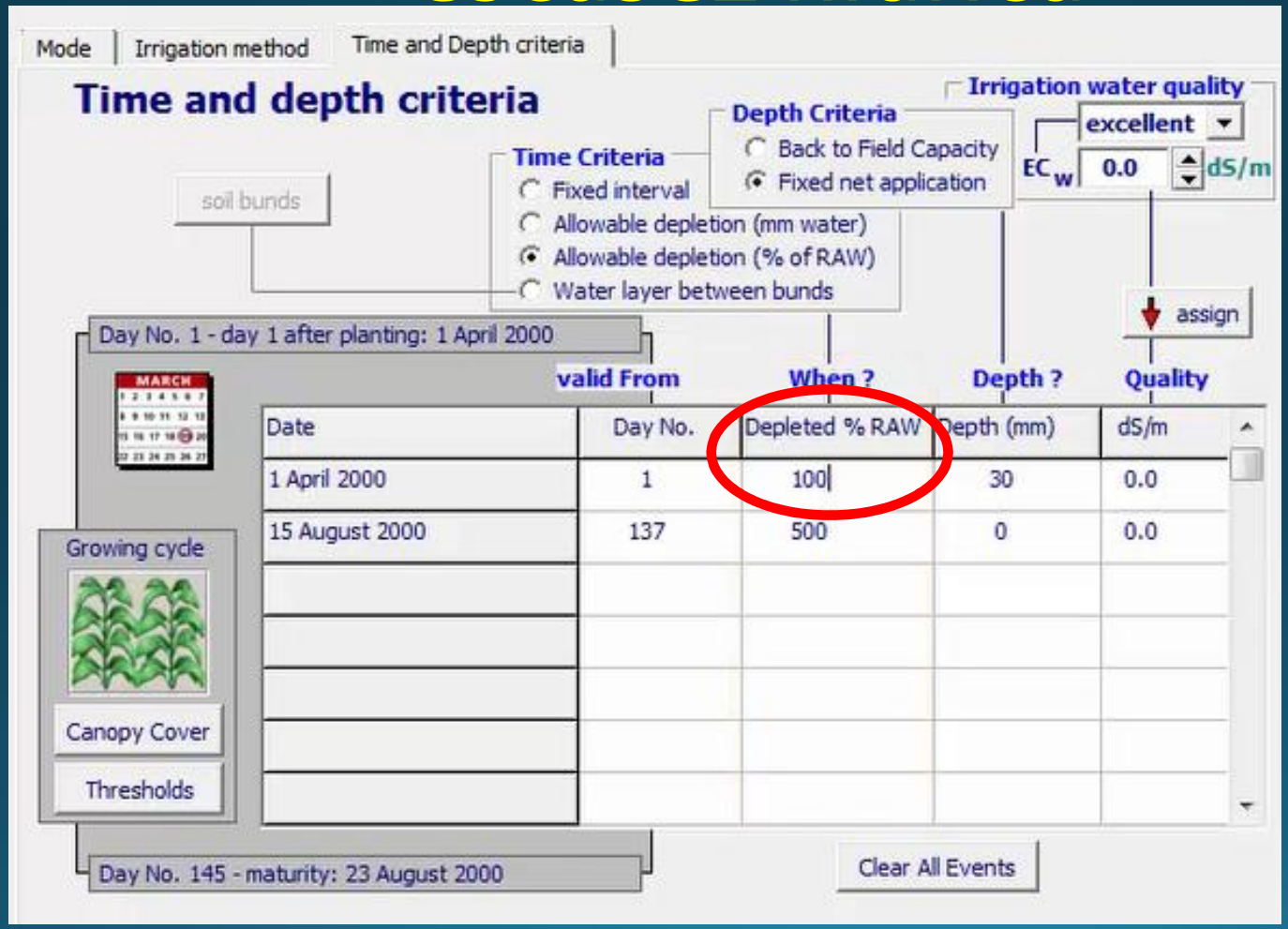
1° Programa de riego

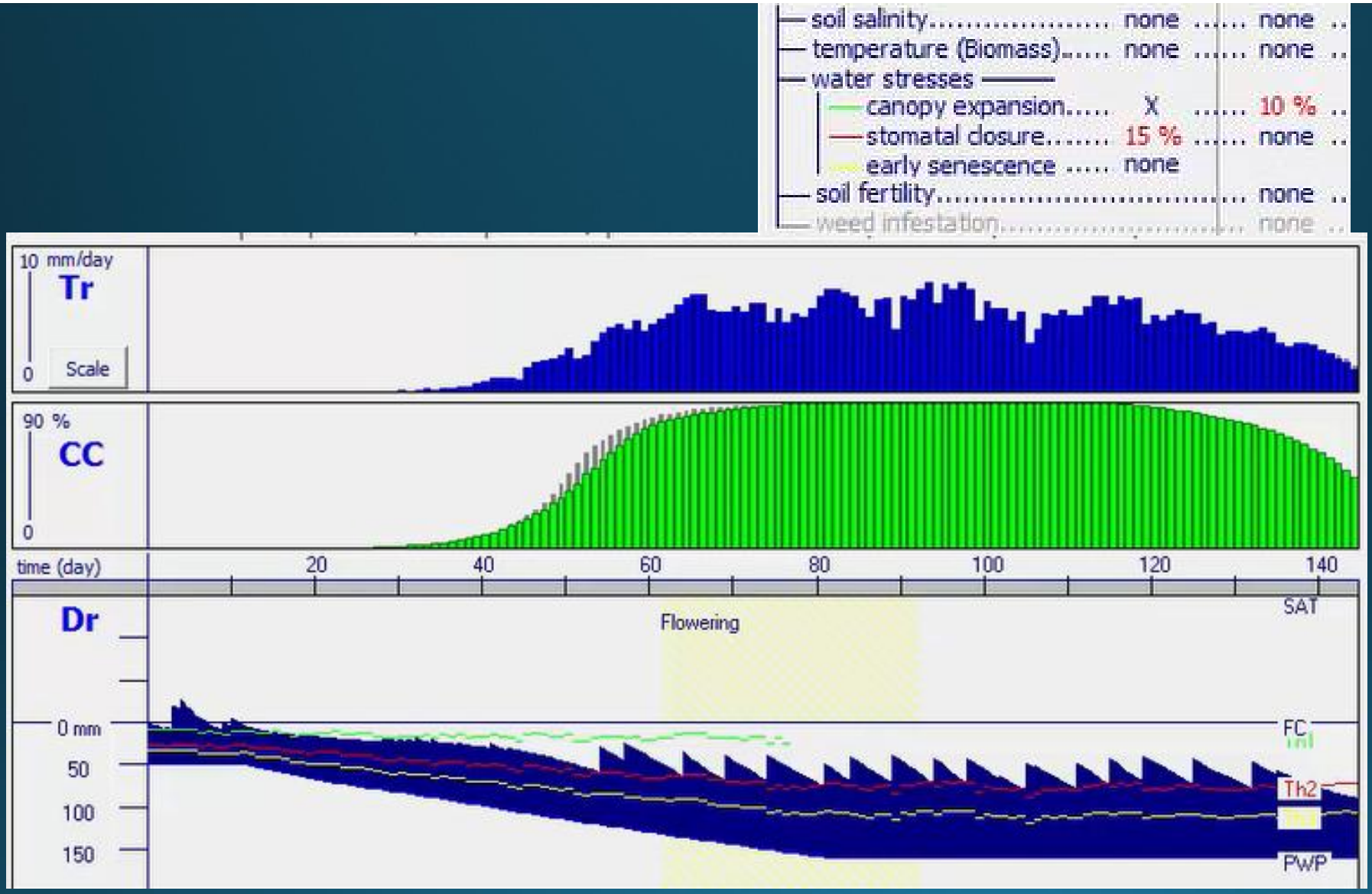




d_{net} = 30 mm	Full irrigation
RAW depleted (%)	40
Irrigation off	15 August
Irrigation - amount (mm) - events (number)	 600 20
Yield (ton/ha)	10.0
WP_{ET} (kg/m³)	1.46

2° Programa de riego bajo un periodo de escasez hídrica

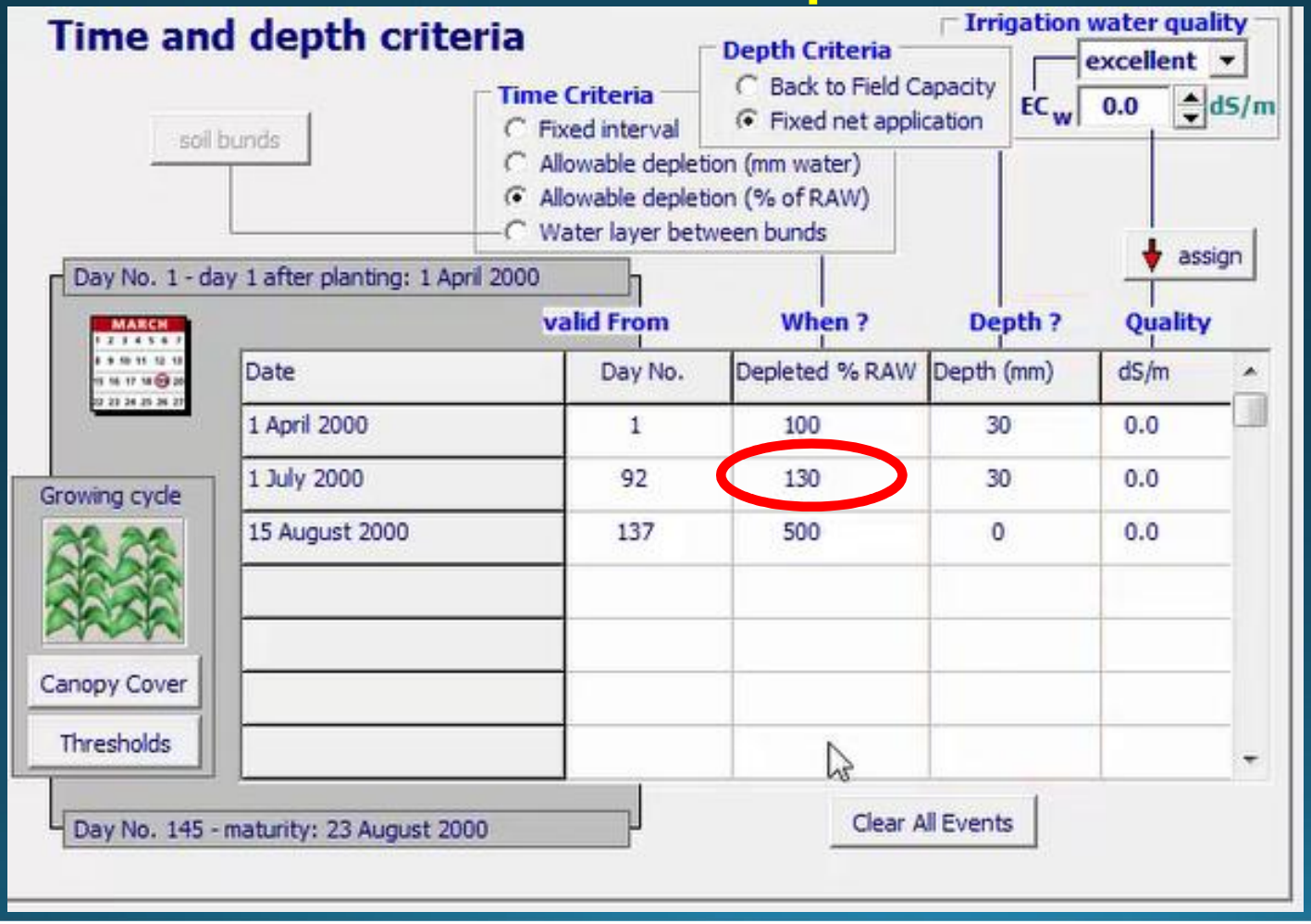


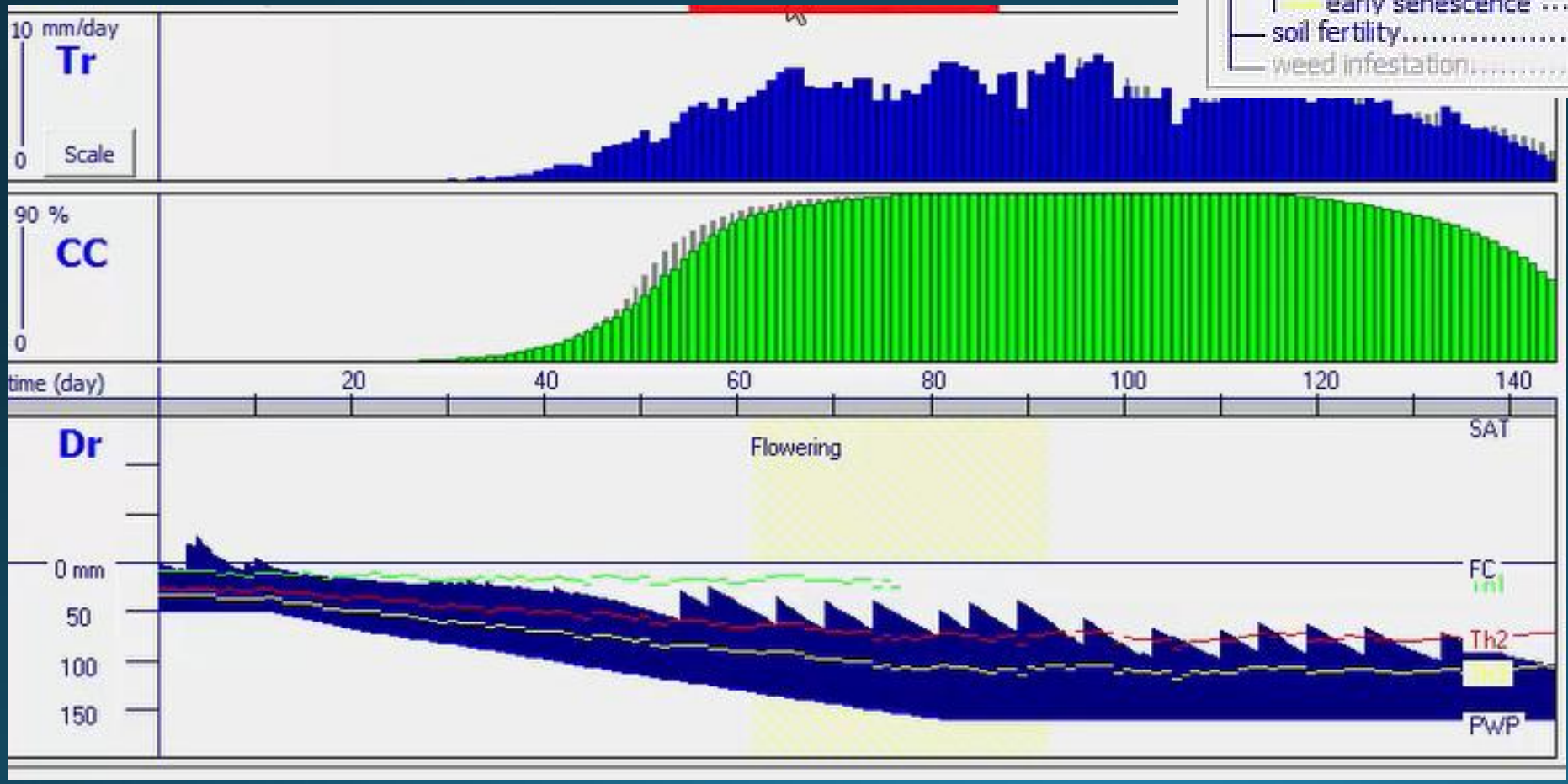

soil salinity..... none ..... none ..
temperature (Biomass)..... none ..... none ..
water stresses
canopy expansion..... X ..... 10 % ..
stomatal closure..... 15 % ..... none ..
early senescence ..... none
soil fertility..... none ..
weed infestation..... none ..
10 mm/day
Tr
0
Scale
90 %
CC
0
time (day)
20
40
60
80
100
120
140
Dr
SAT
Flowering
0 mm
50
100
150
FC
Th2
PWP

d_{net} = 30 mm	Full irrigation	Alternative strategies saving water		
RAW depleted (%)	40	100		
Irrigation off	15 August			
Irrigation - amount (mm) - events (number)	reference 600 20	25% 450 15		saved
Yield (ton/ha)	10.0	9.8		
WP_{ET} (kg/m³)	1.46	1.56		

Fuente: Aquacrop-Training module, FAO (2016)

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



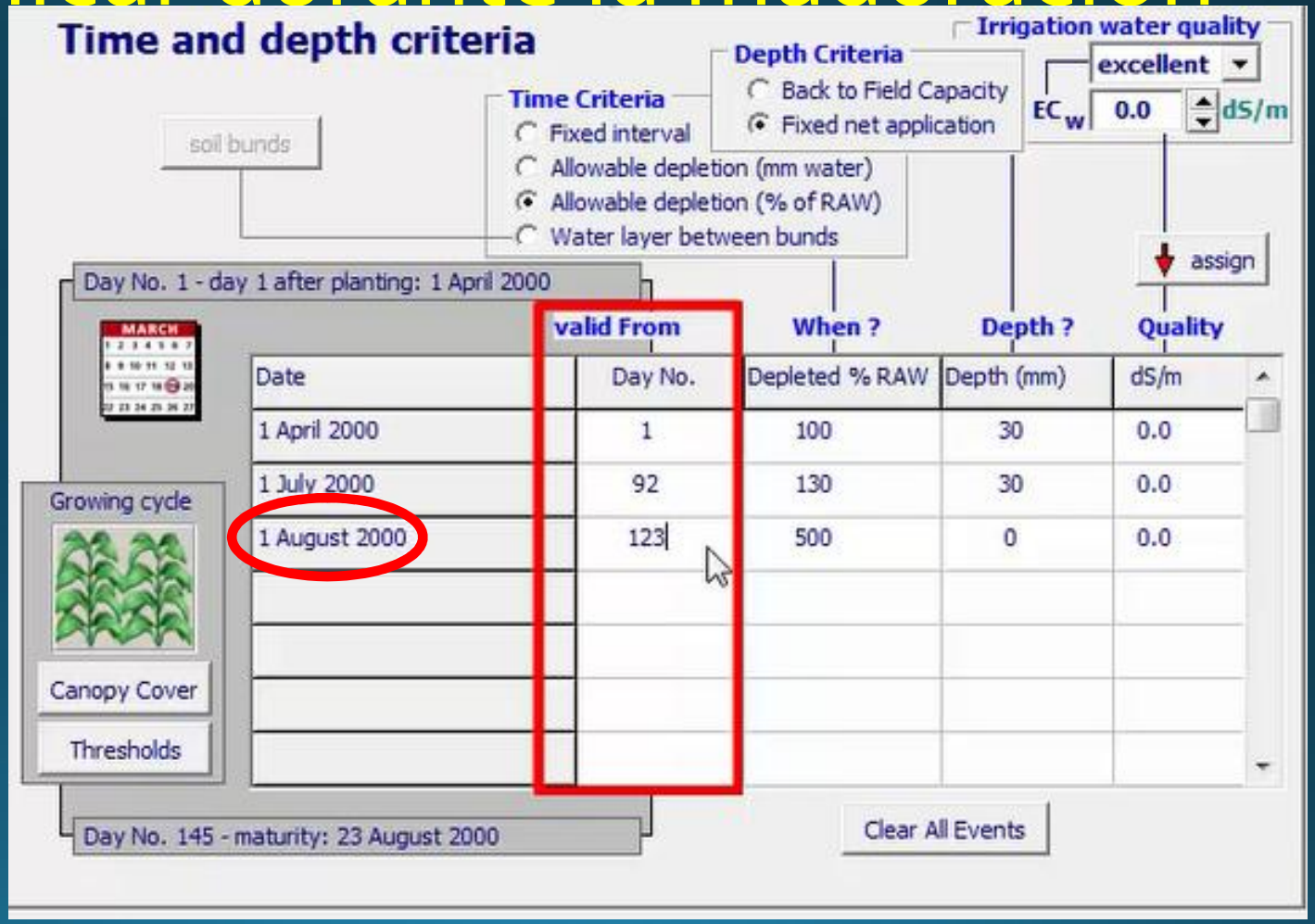


Stresses		average crop cycle
soil salinity	none	none
temperature (Biomass)	none	none
water stresses		
canopy expansion	X	10 %
stomatal closure	33 %	3 %
early senescence	none	
soil fertility		none
weed infestation		none

d_{net} = 30 mm	Full irrigation	Alternative strategies saving water			
RAW depleted (%)	40	100	100 130 (at 1 July)		
Irrigation off	15 August				
Irrigation - amount (mm) - events (number)	reference 600 20	25% 450 15	30% 420 14		saved
Yield (ton/ha)	10.0	9.8	9.5		
WP_{ET} (kg/m³)	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



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

d_{net} = 30 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/m³)	1.46	1.56	1.55	1.54

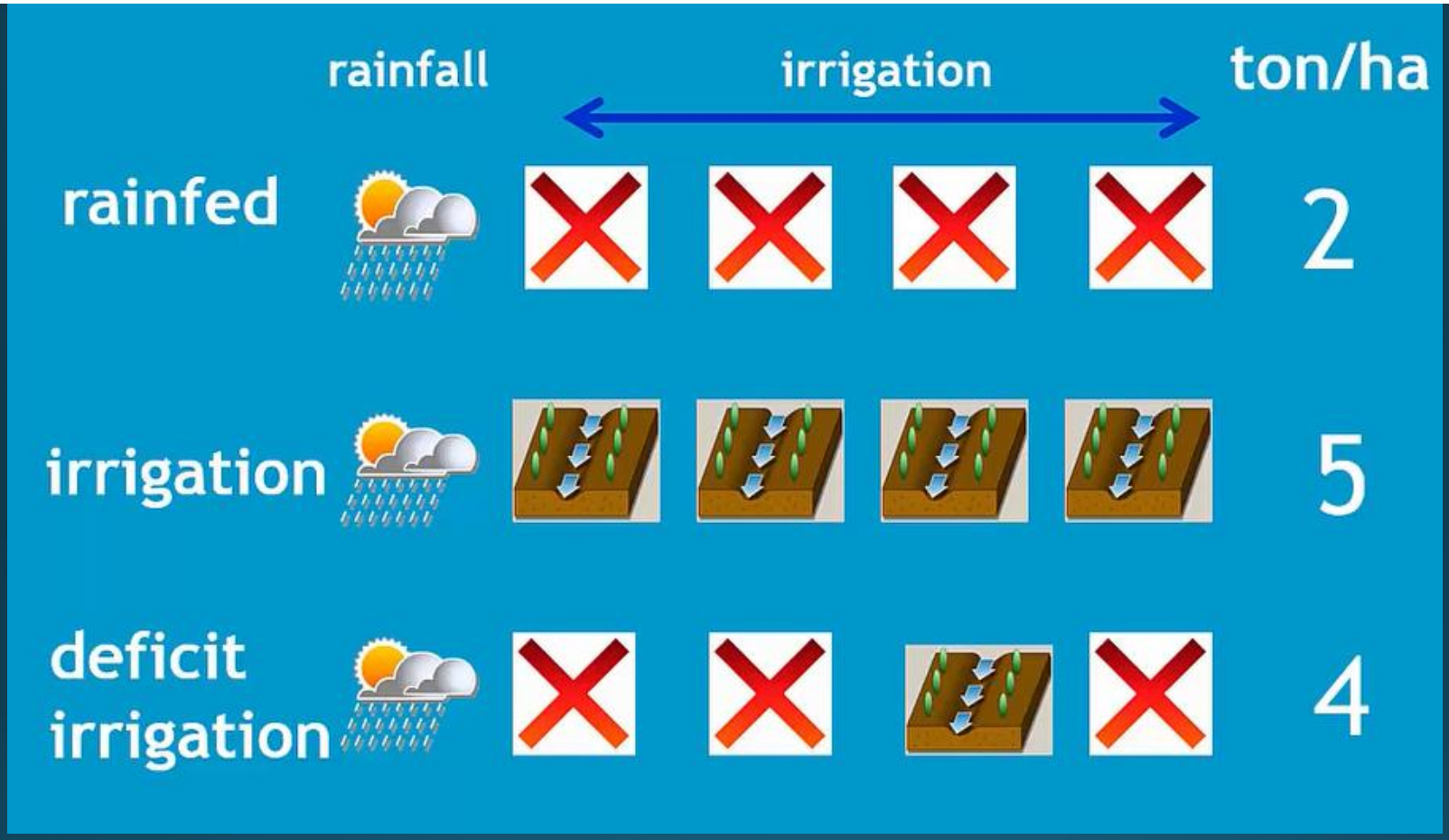
saved

deficit irrigation

for each 6,000 m³ available irrigation water

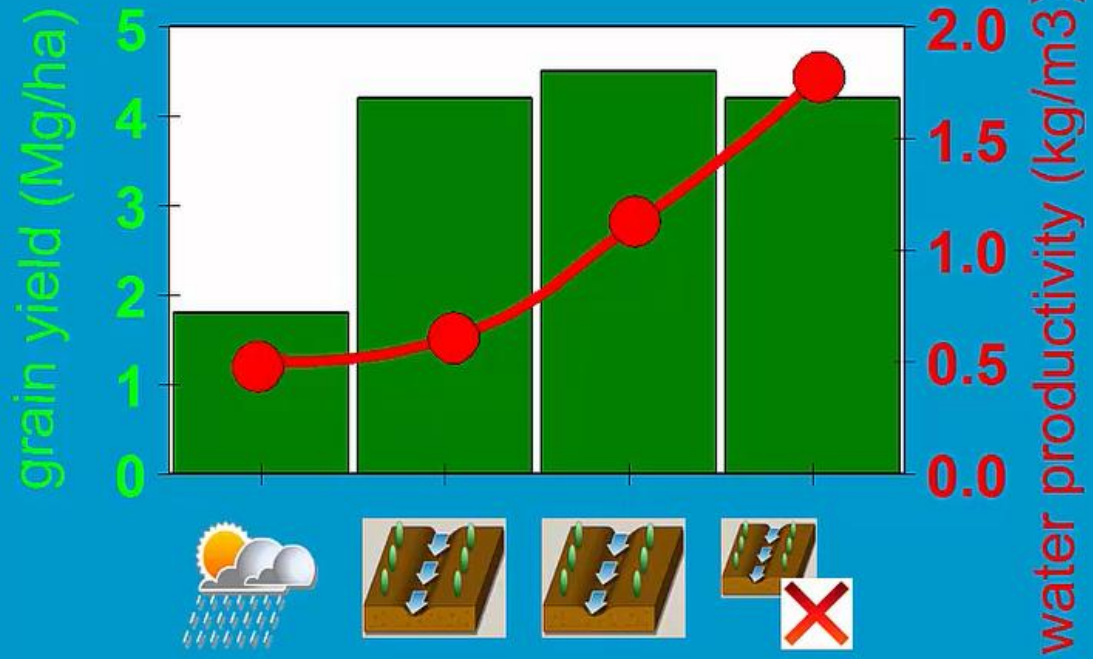
Irrigated area	1 ha	(6,000/3,600 =)	1.67 ha
Dry yield	10 ton	(1.67 x 9 =)	15 ton

50 % yield increase



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

ET water productivity (WP_{ET})



Irrigation strategy	none	local	guidelines	deficit	
	-	2.980	2.220	1.110	m^3/hectare

Source IWMI. annual report 2002-2003