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College of Soil Physics

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Soil salinization and sodification processes 3

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GIVEN DATA

Crop	Water	Soil	Date	Place
Orange	River Segre	Raimat	12/02/1998	Lleida

CLIMATE (Rainfall:Hp) and CROP (Evapotranspiration:Het) month by month

Month	January	February	March	April	May	June	July	August	September	Octover	November	December
Het (mm)	10	20	50	80	90	100	110	85	40	20	15	15
Hp (mm)	40	30	50	50	40	10	20	10	20	70	30	30
Het-Hp	-30	-10	0	30	50	90	90	75	20	-50	-15	-15
Het-Hp adjusted 0	0	0	0	30	50	90	90	75	20	0	0	0

IRRIGAT. WATER

	(Na) Na+	(Ca) Ca++	(Mg) Mg++	(Cl) Cl-	(S) SO4=	(B) HCO3-
meq/liter	3.0	1.5	1.0	0.5	2.0	3.0

Negative values not valid

Salts				
	NaB	MgB	CaCl	CaS
	0.5	1.0	-3.5	-1.5

Negative values adjusted to 0

Salts				
	NaB	MgB	CaCl	CaS
	0.5	1.0	0.0	0.0

SOIL

Depth mm	BD(g/cc)	FC (vol/vol)	I (mm/h)	SP	F	Corresponding maximum values of SAR and TS in saturation extract (se) SARse - TSse		SARse - TSse		SARse - TSse	
600	1.2	0.3	1	yes	0.8	15	40	20	80	30	120

CROP	SOIL	Maximum TSse	Maximum Cles	Maximum SARse
		40	10	15

OTHER LIMIT. Max.Irr.Water m3/ha/month: 3000 — Max.Salinity Drain.Water (kg/ha/ye Kg/ha.year): 40000 — (g / l): 7

		VALID OPTION		dig control
B-(Ca+Mg)	0.5	A	NO	0
10LFa-B	-1.63	B	NO	0
30LFa-CaS	4.13	C	NO	0
		D	NO	0
		E	OK	1

RESULTS

(a)	B<=(Ca+Mg)	<0								
	LF(TS)	LF(Cl)	LF(Na)	Lfa	Nase	Case	Mgse	Clse	NaBse	
	0.14	0.05	0.03	0.14	22	11	7	4	0	
					(Ca+Mg)Cs	CaSs	(Ca+Mg)Cp	CaSp		
					-1.63	4.13	0	0		
(b)	10LFa<B	<0								
	30LFa>=CaS	>0								
	LF(TS)	LF(Cl)	LF(Na)	Lfb	Nase	Case	Mgse	Clse	NaBse	
	0.08	0.05	0.12	0.12	25	6	0	4	0	
					(Ca+Mg)Cs	CaSs	(Ca+Mg)Cp	CaSp		
					0	3.5	1.8	0		
(c)	10LFa<B	<0								
	30LFa<CaS	<0								
	LF(ST)	LF(Cl)	LF(Na)	Lfc	Nase	Case	Mgse	Clse	NaBse	
	400.00	0.05	0.03	400.00	0	40	0	0	0	
					(Ca+Mg)Cs	CaSs	(Ca+Mg)Cp	CaSp		
					0	0	-3997.00	-12000.00		
(d)	10LFa>=B	>0								
	30LFa<CaS	<0								
	LF(ST)	LF(Cl)	LF(Na)	Lfd	Nase	Case	Mgse	Clse	NaBse	
	0.55	0.05	0.04	0.55	5.45	32.73	1.82	0.91	0	
					(Ca+Mg)Cs	CaSs	(Ca+Mg)Cp	CaSp		
					2.50	0	0	-16.50		
(e)	B>(Ca+Mg)	>0								
	LF(ST)	LF(Cl)	LF(Na)	Lfe	Nase	Case	Mgse	Clse	NaBse	
	0.08	0.05	0.18	0.18	16.77	1.50	1.00	2.80	2.795085	
					(Ca+Mg)Cs	CaSs	(Ca+Mg)Cp	CaSp		
					0	0	2.05	0		

FINAL RESULTS

Final Value of LF	LF	LF(ST)	LF(Cl)	LF(Na)
	0.18	0.08	0.05	0.18

IRRIGATION AND DRAINAGE

L		
0.22	OK	limite L<1

	MONTH	January	February	March	April	May	June	July	August	September	October	November	December	Average Year	Maximum m3/ha.month		Total m3 / ha.year
0 if <0	Hr(mm)	0	0	0	39	64	116	116	97	26	0	0	0		1159	OK	4572
0 if <0	Hd(mm)	0	0	0	9	14	26	26	22	6	0	0	0		259		1022
	Tr/Tor	0.00	0.00	0.00	0.05	0.09	0.16	0.16	0.13	0.04	0.00	0.00	0.00	0.05			
30 if >30	Termax (days)	#DIV/0!	#DIV/0!	#DIV/0!	108	65	36	36	43	162	#DIV/0!	#DIV/0!	#DIV/0!				
Irr,Management		Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	Conventional	*lim manag.*		
	Hr/Het	0	0.00	0.00	0.48	0.72	1.16	1.05	1.14	0.64	0.00	0.00	0.00	0.43			
Lim.Irr.Water		No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	No Limitation	*lim irrigation*		
	Hd/Het	0	0.00	0.00	0.11	0.16	0.26	0.24	0.25	0.14	0.00	0.00	0.00	0.10			
Lim. Drainage		No Limitation	No Limitation	No Limitation	Moderate L	Moderate L	Moderate L	Moderate L	Moderate L	Moderate L	No Limitation	No Limitation	No Limitation	No Limitation	*lim drainage*		

EQUILIBRIUM COMPOSITION

Soil Solution	Nase	Case	Mgse	Clse	NaBse	S	B	TSse	SARse	TSse (g/l)
meq / l	17	2	1	3	3			19	15	1.2
Disol. (s) Precip.(p)	**(Ca+Mg)Cs**	**CaSs**	**(Ca+Mg)Cp**	**CaSp**						
meq/l of irrigation water	0.0	0.0	2.1	0.0						
Drainage water	Nad	Cad	Mgd	Cld	NaBd	S	B	TSd	SARd	TSd (g/l)	TSd(kg/ha.year)
meq/l	13	1	1	2	2			15	13	1.0	1009
		Correct Soil Solution. Add Dissolved Salts								OK	OK
		Correct Drainage, according to new Soil Solution									

SUMMARY

Factors			Problem	Limitations			Precip	Disol	NaBes	Max.Requ. Irr.Water	Salts drainage water		
Crop	Water	Soil		Irrig. Manag.	Irr.Water	Drainage				m3/ha/month	kg/ha year	g / l	Ter max (days)
Orange	River Segre	Raimat	SODICITY	Conventional	No Limitation	No Limitation	Carb	No	3	1159	1009	1.0	36
									ALKALINITY				

BD: Bulk Density; **FC**: Field Capacity (volumetric fraction); **I**: Infiltration Rate (mm/hour); **SP**: Salts Precipitated in the original soil; **F**: Leaching Efficiency (TSd/TSse) or (Nad/Nase); **d**: drainage water; **se**: saturation extract; **SARse**: Sodium adsorption ratio in saturation extract (Nase/((Case+Mgse/2)1/2) (milimols/liter)1/2; **TSse**: Total Salts in saturation extract (meq/liter); **Clse**: Chlorides in saturation extract (meq/liter); **L**: Leaching fraction (STr/Stse) or (Clr/Clse) or (Nar/Nase); **LF**: Effective leaching requirement for TS, Cl and Na control; **Hr**: Irrigation water requirement (mm/month); **Hd**: Drainage water requirement (mm/month); **Tr**: Time irrigation (days); **Ter**: Irrigation interval (days); **Nase**, **Case**, **Mgse**, **Clse**, **NaBse**, **TSse**, **SARse**: Na, Ca, Mg, Cl, Na bicarbonates, Total Salts and Sodium Adsorption Ratio in saturation extract(se); **(Ca+Mg)Cs**, **(Ca+Mg)Cp**: Ca+Mg Carbonates disolved (s) or precipitated (p) in the soil (meq/liter of irrigation water); **CaSs**, **CaSp**: Ca Sulphates dissolved(s) or precipitated(p) in the soil (meq/liter of irrigation water); **Nad,Cad, Mgd, Cld, NaBd, TSd, SARd**: Na, Ca, Mg, Na Bicarbonates, Total Salts and Sodium Adsorption Ratio in drainage water (d)

OBSERVATIONS: