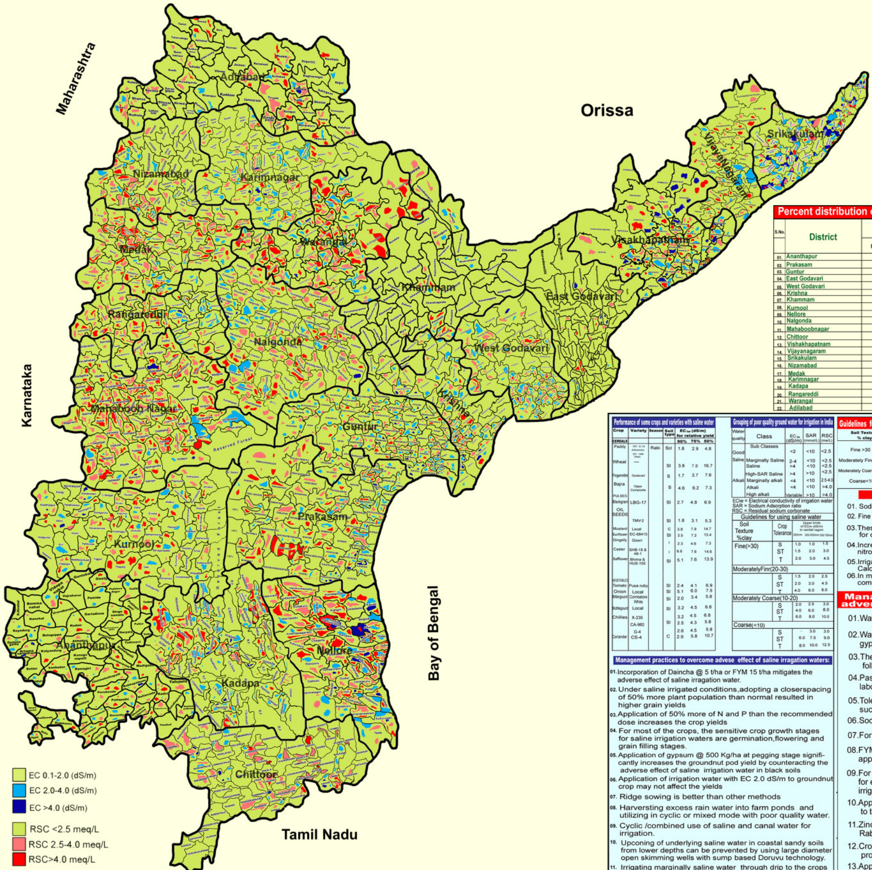
ACHARYA N.G.RANGA AGRICULTURAL UNIVERSITY

ICAR

All India Co-ordinated Research Project on Management of Salt Affected Soils and Use of Saline Water in Agriculture



Percent distribution of underground irrigation waters (EC_{iw} and RSC)

S.No.	District	EC_{iw} (dS/m) (%) 0.1 - 2.0	2.0 - 4.0	> 4.0	RSC (meq/L) (%) < 2.5	2.5 - 4.0	> 4.0
01.	Ananthapur	92.1	6.8	1.1	51.5	21.7	26.8
02.	Prakasam	76.8	17.5	5.6	59.1	18.3	22.6
03.	Guntur	77.8	18.1	4.1	77.2	18.5	4.3
04.	East Godavari	80.6	6.2	13.2	85.3	8.5	6.2
05.	West Godavari	84.7	13.6	1.7	84.1	13.7	2.2
06.	Krishna	77.6	17.9	4.5	79.8	16.7	3.5
07.	Khammam	97.5	2.5	0.0	89.7	6.5	3.8
08.	Kurnool	90.8	8.4	0.8	74.0	14.3	11.7
09.	Nellore	86.9	9.9	3.2	49.3	20.6	30.1
10.	Nalgonda	92.4	7.1	0.6	68.3	18.9	12.8
11.	Mahaboobnagar	96.9	2.7	0.4	53.7	19.9	26.4
12.	Chittoor	90.7	8.6	0.7	81.2	15.3	3.5
13.	Vishakhapatnam	85.8	11.2	3.0	67.0	15.1	17.9
14.	Vijayanagaram	96.3	3.7	0.0	81.7	9.0	9.3
15.	Srikakulam	85.9	12.0	2.1	89.0	7.5	3.5
16.	Nizamabad	95.6	4.1	0.3	83.7	10.5	5.8
17.	Medak	97.4	2.6	0.0	73.5	15.9	10.6
18.	Karimnagar	91.6	7.8	0.6	92.1	5.4	2.5
19.	Kadapa	87.0	11.6	1.4	67.2	13.8	19.0
20.	Rangareddi	93.0	6.0	1.0	79.6	10.9	9.5
21.	Warangal	91.4	7.9	0.7	61.0	14.7	24.3
22.	Adilabad	97.8	2.1	0.1	88.4	7.7	3.9

Performance of some crops and varieties with saline water

Crop	Variety	Season	Soil type	EC_{iw} (dS/m) for relative yield 90%	75%	50%
CEREALS						
Paddy	RP-4-14 (PRAKASH) IET-1444 (Rasi)	Rabi	Scl	1.8	2.9	4.8
Wheat	—		Sl	3.8	7.8	16.7
Fingermillet	Godavari		S	1.7	3.7	7.6
Bajra	Vijaya Composite		S	4.6	6.2	7.3
PULSES						
Blackgram	LBG-17		Sl	2.7	4.8	6.9
OIL SEEDS						
	TMV-2		Sl	1.8	3.1	5.3
Mustard	Local		C	3.8	7.9	14.7
Sunflower	EC-68415		Sl	3.5	7.2	13.4
Gingelly	Gowri		l	2.3	4.6	7.3
Caster	SHB-18 & 48-1		l	6.6	7.6	14.6
Safflower	Bhima & HUS-105		Sl	5.1	7.6	13.9
VEGETABLES						
Tomato	Pusa ruby		Sl	2.4	4.1	6.9
Onion	Local		Sl	5.1	6.0	7.5
Bittergourd	Coimbatore White		Sl	2.0	3.4	5.8
Bottlegourd	Local		Sl	3.2	4.5	6.8
Chillies	X-235			3.2	4.5	6.8
	CA-960		Sl	2.5	4.3	5.8
	G-4			2.6	4.5	5.8
Coriander	CS-4		C	2.9	5.8	10.7

Grouping of poor quality ground water for irrigation in India

Water quality	Class	EC_{iw} (dS/m)	SAR (mmol/L)	RSC (me/L)
	Sub Classes			
Good		<2	<10	<2.5
Saline	Marginally Saline	2-4	<10	<2.5
	Saline	>4	<10	<2.5
	High-SAR Saline	>4	>10	<2.5
Alkali	Marginally alkali	<4	<10	2.5-4.0
	Alkali	<4	<10	>4.0
	High alkali	Variable	>10	>4.0

ECiw = Electrical conductivity of irrigation water
SAR = Sodium Adsorption ratio
RSC = Residual sodium corbonate

Guidelines for using saline water

Soil Texture %clay	Crop Tolerance	Upper limits of ECiw (dS/m) in rainfall region 350mm	350-550mm	550-750mm
Fine(>30)	S	1.0	1.0	1.5
	ST	1.5	2.0	3.0
	T	2.0	3.0	4.5
ModeratelyFinr(20-30)				
	S	1.5	2.0	2.5
	ST	2.0	3.0	4.5
	T	4.0	6.0	8.0
Moderately Coarse(10-20)				
	S	2.0	2.5	3.0
	ST	4.0	6.0	8.0
	T	6.0	8.0	10.0
Coarse(<10)				
	S	-	3.0	3.0
	ST	6.0	7.5	9.0
	T	8.0	10.0	12.5

Guidelines for using Alkali /Sodic waters

Soil Texture % clay	Upper limits of SAR	RSC
Fine >30	10	2.5-3.5
Moderately Fine (20-30)	10	3.5-5.0
Moderately Coarse(10-20)	15	5.0-7.5
Coarse<10	20	7.5-10.0

Gypsum to be applied (Kgs/ha)

No.of Irrigations	RSC of water (me/L)	RSC to be Neutralized	Heavy textured soils Kg/ha	light textured soils Kg/ha	Sandy loams Kg/ha	Sandy soils
5	5	5-4=1	300	200	100	Occasional gypsum application is sufficient to improve crop yield
	6	6-4=2	600	400	200	
	7	7-4=3	900	600	300	
	8	8-4=4	1200	800	400	

Management practices to overcome advese effect of saline irragation waters:

01. Incorporation of Daincha @ 5 t/ha or FYM 15 t/ha mitigates the adverse effect of saline irragation water.
02. Under saline irrigated conditions,adopting a closerspacing of 50% more plant population than normal resulted in higher grain yields
03. Application of 50% more of N and P than the recommended dose increases the crop yields
04. For most of the crops, the sensitive crop growth stages for saline irrigation waters are germination,flowering and grain filling stages.
05. Application of gypsum @ 500 Kg/ha at pegging stage significantly increases the groundnut pod yield by counteracting the adverse effect of saline irrigation water in black soils
06. Application of irrigation water with EC 2.0 dS/m to groundnut crop may not affect the yields
07. Ridge sowing is better than other methods
08. Harversting excess rain water into farm ponds and utilizing in cyclic or mixed mode with poor quality water.
09. Cyclic /combined use of saline and canal water for irrigation.
10. Upconing of underlying saline water in coastal sandy soils from lower depths can be prevented by using large diameter open skimming wells with sump based Doruvu technology.
11. Irrigating marginally saline water through drip to the crops covered with organic mulch improves yield
12. Excessive doses of Fe and Zn appliction reduce the uptake of Arsenic by edible parts of leafy of leafy vegetables and root crops.

Harmful Effects of Alkali/sodic Water:

01. Sodic water adversely affects soil physical properties
02. Fine textured soils remain dispersed and puddle when wet and hard when dry
03. These soils do not easily attain proper soil moisture condition for cultivaton
04. Increase in soil pH reduces the availability of plant nutrients like nitrogen, phosphorus, zinc, iron etc.
05. Irrigation with sodic water also results in decreased availability of Calcium and magnesium and toxicity of sodium
06. In most cases, the yield of crops is adversely affected by a combination of these factors.

Management practices to overcome the adverse of sodic irrigation waters:

01. Water with RSC less than 2.5meq/L is safe for irrigation.
02. Water with RSC between 2.5 to 4.0 meq /L needs occasional gypsum application to improve crop yields
03. The best time for gypsum application is after summer showers followed by ploughing to a shallow depth
04. Passing sodic water through gypsum beds is equally good and labour saving
05. Tolerant and semi tolerant crops having high water requirement such as rice, sugarcane etc can be avoided.
06. Sodic water should not be used for growing summer crops.
07. For rice occasinal gypsum application will improve crop yield.
08. FYM application should be accompanied by the gypsum application
09. For Groundnut crop, gypsum should be applied @ 500 Kg/ha for each crop especially where RSC waters are used for irrigation.
10. Application of 25% extra Nitrogen is needed as compared to the normal condition.
11. Zinc sulphate @ 25 Kg/ha. should be added particularly to the Rabi crops grown with alkali water.
12. Crop rotation improves the yield and soil physico -chemical properties under sodic water condition.
13. Application of FYM 10 t/ha. and passing RSC water through gypsum, Vegetable crops like brinjal, tomoto, Cabbage and cucumber etc., can be grown successfully.
14. Maize fodder crop is highly sensitive to alkali water irrigation.

Source : Principal Scientist (SS), Saline Water Scheme, Bapatla - 522 101, Ph: 08643-225098


Rainwater Management


Conjunctive use of saline water


skimming well


Planting rice seedlings of older age (35-40 Days) and higher population (45-60 hills /m²)


Green Manuring with dhaincha (Sesbania sp.)


Typical symptoms of biotoxicity of pollutants

Treating the sodic water before application


A plantation of eucalyptus raised through the use of sewage water


Pit auger-hole technology


Non-edible high value crops like flowers and aromatic grasses hold potential to biormediate the heavy metal contaminated soil