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EFFECT OF BORE WELL SALINE WATERS ON THREE RICE TYPES

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Besides the soil properties, salt tolerance of the crop is a major factor determining the suitablity of a saline water for irrigation. Within the rice crop, significant varietal differences in their salt tolerance were observed (Balasubramanian, 1965; Murty and Rao, 1965; Varghese and Thambi, 1966; Janardhan and Murty, 1972). Among the high yielding and photoinsensitive types, information on their performance under saline conditions Is scanty. A comparison of three rice types on their performance with bore well waters at different salinity levels was made in a pot culture study.

Materials and Methods

Earthen pots (20 cm x 30 cm in size) were filled with the alluvial clay soil (pH 7.0; Organic matter 1.10%. ECe 0.18 mmhos/cm; CEC 31.2/100 h; ESP 3.0) obtained from the low land rice fields of the Annamalai University. Three borewell saline waters of electrical conductivity (EC) 15CO, 2000 and 2500 micromhos per cm and rain water of EC 24 micromhos per cm (Control) were used for the experiment. For practical purpose salinity level of rain water was taken as zero and noted accordingly in the Tables 2 and 3. Chemical composition of the waters used is furnished in Table 1 soils in the pots were submerged separately with the waters of the four quality metnioned. Rice seeds of ADT-31, Ac 1 and Ac. 2 were soaked separately in these waters and the germinated seeds sown in pots and maintained with the respective waters. Twenty day old seedlings were transplanted in the main pots submerged earlier. Experiment was conducted during March—June 1975. Urea and complex

Table 1 Chemical composition of bore well waters

Water sample	EC (Micromhos/cm)	PH	Ca^{++}	Mg^{++}	Na^{+}	K^{+}	$CO_3^{=}$	HCO_3^{-}	Cl	$SO_4^{=}$	SAR
							ml/1				
1.	1500	7.9	2.2	3.0	9.0	0.1	0.5	6.6	6.0	1.5	5.6
2.	2000	8.2	1.8	2.8	15.2	0.1	0,2	6.8	10.6	2.1	10.1
3.	2500	8.8	2.0	2.6	20.2	0.1	0.9	9.2	12.2	2,2	13.5

fertilizers were applied to the pots to supply N, P and K at 130, 65 and 65 Kg per ha respectively. Four cm depth of water was maintained in the pots throughout. All the three rice types matured after 105 days of sowing. The experiment was replicated four times with twelve treatment combinations in a randomised design.

Table 2 Effect of salinity on yield and yield attributes of rice

Plant type i evels	Water Salinity Electrical conductivity in micromhos/cm	Grain weight g/pot		Panicle No. hill		Grain No./ Panicle		Sterility per cent	
ADT—31	0	42.10	(6.56)	15.00	(4.0)	115.75	(10.78)	11.85	(20.12)
	1500	20.20	(4.60)	7.00	(2.8)	1C4.25	(10.25)	23.00	(28.99)
	2000	0.00	(1.00)	0.01	0.0)	0.00	(1.00)	100.00	(90,00)
	2500	0.00	(1.00)	0.01	(1.0)	0.00	(1.00)	100.00	(90.00)
AC—1	0	42.15	(6.56)	14.00	(3.9)	129.25	(11.40)	7.60	(15.99)
	1500	39.=0	(6.36)	13.00	(3.7)	116.00	(10.S1)	12,87	(21.01)
	2000	38,00	(6.23)	13.00	(3.7)	104.75	(10.27)	15,10	(22.86)
	2500	33.00	(5.82)	13.00	(3.7)	93.00	(9.68)	17.20	(24.49)
AO—2	0	41.60	(6.52)	14.00	(3.9)	126.00	(11.26)	8.80	(17.25)
	1500	39.10	(6.32)	13,00	(3.7)	120,75	(11.01)	13.22	(21.32)
	2000	37.90	(6.23)	13.00	(3,7)	102.25	(10.15)	15.80	(23,41)
	2500	31.90	(5.73)	13.00	(3.7)	81.25	{ 9.06)	17.72	(24,89)

* Mean of 4 replicates Figures within the parantheses give the transformed values,

C- D. (P = 0.05)					
	Type	0.026	0.06S	0.124	0.438
	Salinity	0.030	0.070	0.144	0.506
	Interaction	0.053	0.120	0.249	0.876

Panicle number per hill, grains per panicle, sterility percent and grain dry weight per pot were recorded. Soils were sampled from the pots at the end of the experiment, dried and analysed for salinity and exchangeable sodium percentage (ESP). Mean values on yield attributes and grain yield are furnished in Table 2, Mean values on soil salinity and ESP are furnished in Table 3.

Results and Discussion

With the use of rain water (Control), the grain yield was the same in ADT-31, AC-1 and AC-2. At other salinity levels, significant differences were noted among three types studied. ADT 31 recorded the lowest yield with water of EC 1500 micromhos per cm and it failed to survive at the

higher EC levels. In water of EC 1500 and 2000 micromhos per cm, Ac-1 and Ac-2 recorded almost similar yields. At the water salinity level of EC 2500 micromhos per cm, Ac–1 yielded more than Ac-2. Yield reduction with the successive increases in water salinity levels was seen in all the three types (Table 2)

By the use of water at a salinity level EC 1500 micromhos per cm, the reduction in panicle number per hill amounted to 53.4 per cent in ADT 31, while it was only 7.1 per cent in both Ac-1 and Ac-2. At higher water salinity levels, ADT-31 dried up while there was no further reduction in panicle number in Ac-1 and Ac-2. The number of grains per panicle was similar in Ac-1 and Ac-2 at lower water salinity levels and it was higher in Ac-1 than Ac-2 at higher water salinity level, of 2500 micromhos per cm. Percentage of sterility was the maximum in ADT 31 and the least in Ac-1 and Ac-2 at all the water salinity levels.

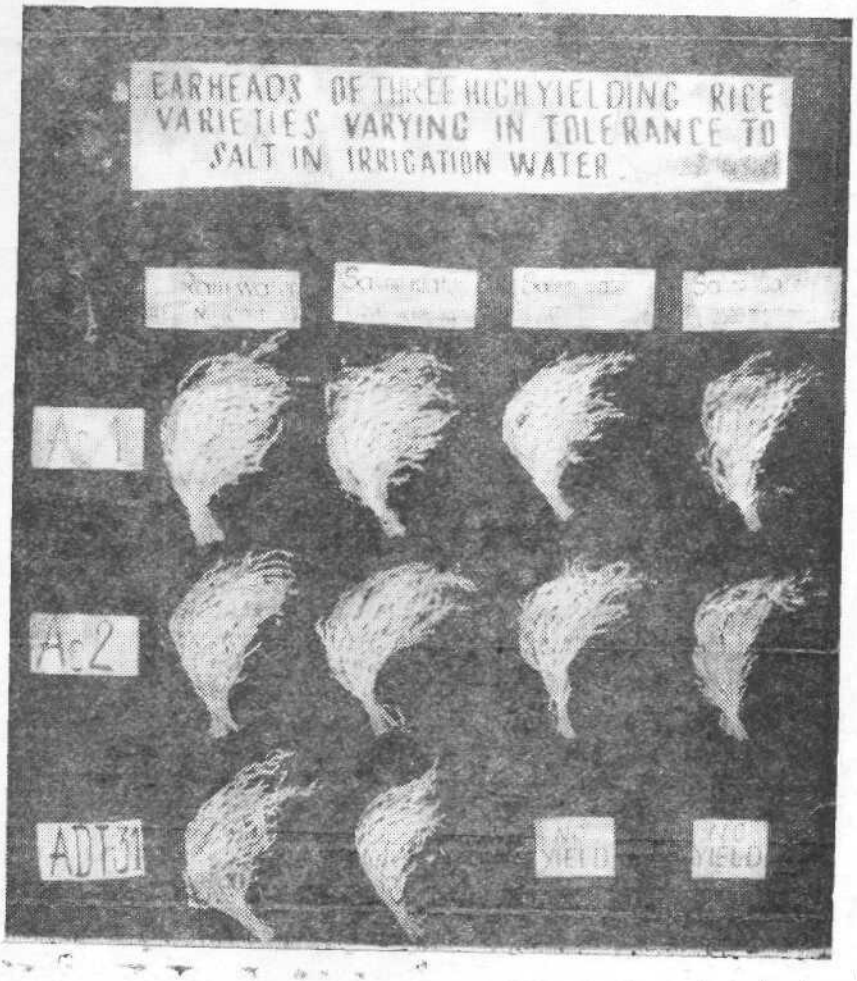
There was a progressive build-up of soil salinity as well as the soil ESP with the increase in the levels of the salinity or the SAR values of the waters used. Thus the initial soil salinity of ECe 0.43 mmhos per cm was raised to a maximum 4,82 mmhos/cm and the initial soil ESP of 3.5 raised to a maximum of 17.8 at the end of experiment, due to the use of water with a salinity level of EC 2500 micromhos per cm and SAR value of 13.5.

Table 3 **Soil** properties at harvest

Quality of the water used		Soil properties					
Salinity Electrical conductivity (EC) in micromhos/cm	Sodium absorption ratio (SAR)	Saliinity *Ecc in millimhos/cm			Exchangeable Sodium percentage (ESP		
		ADT—31	Ac 1	Ac 2	ADT—31	Ac 1	Ac 2
0	0	0.43	0.17	0.17	3.50	3.50	3.50
1500	5.6	3.25	3.35	3,38	10.50	10.20	10.20
2000	10.1	4.32	4.40	4,40	14.30	14.00	13.70
2500	13.5	4.72	4,90	4.82	17,80	17.50	17.50

* Soil—water extract 1;I

C. D. (P = 0.05) Type Not significant 0.055
Fertility level 0.13 0.063
Interaction Not significant 0.107


EARHEADS OF THREE HIGH YIELDING RICE VARIETIES VARYING IN TOLERANCE TO SALT IN IRRIGATION WATER.
Ac 1
Ac 2
ADT 31

The rice types Ac-1 and Ac-2 survived to maturity with waters at all the salinity levels whereas the plants of ADT 31 tolerated the saline water only upto EC 1500 micromhos per cm. The per cent reduction in grain yield due to saline water of EC 1500 micromhos per cm was 48.0 in ADT 31 while it was 6.0 and 6.9 in Ac-1 and Ac-2 respectively. Hayward and Wadleigh (1949) suggested a useful criterion for salt tolerance of crop from the agronomic point of view. It is of interest to note that the yield reduction in Ac-1 and Ac-2 was observed to be due to lesser number of grains per panicle while, in ADT-31, it was mainly due to lesser number of panicles per hill. Use of saline water of EC 1500 micromhos per cm finally built up a mean soil salinity of about 3.5 mmhos per cm and the grain yield reductions in ADT-31. Ac-1 and Ac-2 were 48.0, 6.0 and 6.9 per cent respectively. According to Pearson and Ayres (1960), the rice crop is classed as salt sensitive if its grain yield is reduced by 50 per cent by a soil salinity of ECe 4 mmhos per cm. In accordance with this standard, the ADT-31 is a salt sensitive type while the other two types are salt tolerant. According to Pearson (1960), rice plant growth was observed to be normal in soils having ESP values upto 20. Hence the maximum soil ESP of 17.5 observed in the present pot culture could not be hazardous to any of the three rice types studied.

Summary

Effect of three bore well saline waters of EC 1500, 2000 and 2500 micromhos per cm were compared with rain water (Control) on the performance of three short duration photoinsensitive rice types viz., ADT-31, Ac-1 and Ac-2 in a pot culture experiment with alluvial clay soil of the Annamalai University Experimental Farm. With water of EC 1500 micromhos per cm, Ac-1 and Ac-2 gave significantly higher grain yield than ADT-31. With water of EC 2000 micromhos per cm, ADT-31 failed to survive while the types Ac-1 and Ac-2 survived to maturity and yielded even with water of EC 2500 micromhos per cm. Of the two types Ac-1 and Ac-2, the former was superior. By the use of saline water, hazard on plant was found to be mainly due to build-up of soil salinity but not due to that of ESP. With the introduction of a plant type Ac-1, scope on the efficient use of bore well saline water is indicated.

സംഗ്രഹം

അണ്ണാമല സവ്വകലാശാലയിലെ 'അലൂവിയൽ' fflsmlfffi നടത്തിയ ഒരു പരീക്ഷണത്തിൽ AC—1 എന്ന ഇനം നെൽവിത്ത ഉപ്പകലർന്ന വെള്ളം മാത്രം കഴൽ കിണറുകളിൽ rolcra ലഭിക്കന്ന സ്ഥലങ്ങളിലെ കൃഷിക്ക കൂടുതൽ അനയോജ്യമാണെന്ന കണ്ട.

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