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EFFECT OF SODIC WATER IRRIGATION ON GROWTH AND YIELD OF RICE GENOTYPES

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ABSTRACT

The effect of sodic water irrigation was studied in 36 rice genotypes to evaluate their salt tolerant nature. The influence of naturally occurring sodic water irrigation was studied in pot culture experiments with four sets of treatments as main plots viz., Normal Soil + Normal Water (NS + NW), Normal Soil + Sodic Water (NS + SW), Sodic Soil + Normal Water (SS + NW) and Sodic Soil + Sodic Water (SS+ SW). The sodic water treatments invariably affected the growth, development and yielding potential of the rice genotypes. However, the varietal variation was found to be significant. Among the varieties, Co-43 recorded the highest TDMP, followed by SATVT 2022. The grain yield started declining with shift in either sodic soil or sodic water irrigation. Among the varieties SATVT 2013 recorded the highest yield followed by C0-43 and SATVT 2022. SATVT 2013, SATVT 2022 and Co-43 could be used as potential breeding stocks for imparting salt tolerance.

KEY WORDS: Soil salinity, Sodicity, Sodic Water and Salt tolerance

Soil salinity remains one of the world's most serious environmental problems, which considerably limit global agricultural production. Of the world's available land area of 14 billion ha, only about 3.2 billion ha are arable or potentially arable (Thorne,1970). Even this arable land has many problems, the most important being the presence of excess salts, which greatly reduces the productivity of the land and necessitates the adoption of costly reclamation process. The rice crop the world over is considerably affected by soil salinity. About 60 million ha in Southern and South-Eastern Asia, of which 27 million ha are in the humid tropics are climatically physio graphically and hydrologically suited to rice, but are not cultivated because of salinity (Akbar and Ponnamperuma, 1982). In India, an area of nearly four million ha of rice are affected by soil salinity (Paul and Ghosh,1986).

Rice is usually considered as sensitive to salinity level (Mass and Hoffman, 1977), the threshold soil salinity level tolerated without yield loss being EC 3 dSm^{-1}. However, beyond this level, the yield starts decreasing and drastically reduced at EC of 10 dSm^{-1}. However, sensitivity depends on several plant and environment factors. This variability can vary between species (Lessani and Marschner, 1978) or even between the varieties of same species.The present investigation was made to study the influence of naturally occurring sodic water in combination with sodic soil. The effect of salt water irrigation in a group of rice genotypes was studied in comparison with normal water and normal soil and the results are presented.

MATERIALS AND METHODS

Thirty six rice cultures were employed in the study. Thirty rice cultures of SATVT (Saline Alkali Tolerant Varietal Trial) were evaluated with five standard varieties and one pre release culture. The pot culture study was done with two soil types and two irrigation sources as detailed below.

1. Normal Soil + Normal Water (NS+NW)
2. Normal Soil + Sodic Water (NA+SW)
3. Sodic Soil + Normal Water (SS + NW)
4. Sodic Soil + Sodic Water (SS+SW)

The above four treatments formed the main plots and the varieties formed the subplots . Earthern pots of uniform size of 30 cm upper diameter and 20 cm lower diameter with a height of 40 cm were used. The quantity of 4 kg soil per pot was filled. The characteristics of soil and irrigation water used are given in the table.

The water used belonged to two different categories viz., normal water collected from the

S.No	Properties of soil	Normal soil	Sodic soil
1.	Soil reaction (1:2 soil water)	7.8	9.3
2.	EC (dSm^{-1})	0.48	0.29
3.	CEC (meq / 100g)	19.7	14.3
4.	Organic carbon (%)	0.41	0.38
5.	Av. N(kg/ha)	165.9	121.8
6.	Av.P(kg/ha)	20.4	18.2
7.	Av.K (kg/ha)	185.4	170.8
8.	ESP	13.4	32.8

canal and sodic water collected from the open well in the field No D5b.

The water analysis data are given in the table below.

S.No	Particulars	Normal water	Sodic water
1.	pH	8.20	9.00
2.	EC (dSm^{-1})	0.50	0.67
3.	RSC (meq^{-1})	-1.28	7.92

Nursery was raised in the normal soil and 30 days old seedlings were transplanted in the pots. In each pot 5 hills were planted with four seedlings per hill. There were altogether 288 pots consisting of four treatments, 36 varieties and two replications with single pot per replicate. Irrigation was given with respective source of water so as to maintain at least a centimeter height of water. Observations on the total dry matter production was estimated at harvest from two plants and the mean worked out and expressed in g/ plant for all the 36 varieties under four main plots. The yield of grain was recorded from each pot and mean value was worked out.

RESULTS AND DISCUSSION

The total DMP due to the four main plots treatments ranged from 13.53 to 18.25g/hill irrespective of varieties (Table 1). The data indicated that with switching over either to sodic soil or sodic water irrigation, the DMP was greatly affected. There was a reduction of 10.4, 15.9, and 25.9 per cent in the TDMP in NS+SW, SS + NW and SS+ SW respectively over normal soil+normal water (NS+NW) treatment. The differences in the main plot treatments were found to be significant. Among the varieties Co-43 recorded the highest mean TDMP of 22.79 g/ hill followed by SATVT 2022 with 21.012 g/ hill. The varietal variation in response to four main plot treatments and the interaction were found to be significant. It was evident that the sodic soil and sodic water reduced the TDMP in all the varieties. However, the reduction was least in case of salt tolerant genotypes. Earlier it was shown that the saline water irrigation reduced the TDMP in a wide range of crops (Manchanda, 1980; Lal and Lal, 1980). The grain yield under NS+NW condition ranged from 8.45 g/hill in SATVT 2011 to 12.55 g hill-1 in Co-43 (Table 2). Under SS+SW the range being 7.1 in SATVT 2011 and SATVT 2016 to 12.25 in SATVT 2013. It was evident that the grain yield started declining with the shift to either sodic soil or sodic water irrigation. The reduction was significant irrespective of varieties and to the tune of 5.9, 10.4 and 5.2 per cent respectively in the NS+SW, SS+NW and SS+SW. Among the varieties the highest mean yield of 12.99 g hill-1 was recorded in SATVT 2013 irrespective of treatments indicating its salt tolerant nature. This is closely followed by Co-43 and SATVT 2022 with 12.19 and 12.14 g $hill^{-1}$ respectively. The effect of salt stress on reducing the yield of rice was given by Akbar et al. (1972).

The reduced yield might be due to reduction in the number of spikelets or setting percentage. The salt tolerance nature of Co-43 was shown by Krishnamurthy et al. (1987) which agrees with the present findings. Co-43, SATVT 2013 and SATVT 2022 were found to perform well under natural soil sodicity and outyield other varieties even in super imposed sodic water treatments, evidently showing high salt tolerant characteristics. These rice varieties can well be utilized in breeding for salt tolerance characteristics besides making use of TDMP and yield under stress, as criteria for screening rice genotypes for salt tolerance.

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Table 1. Effect of soil types and sources of irrigation on TDMP (g hill^{-1}) in 36 rice genotypes

Genotype	NS+NW	NS+SW	SS+NW	SS+SW	Sub-plot mean
SATVT 2001	17.40	16.20	16.20	10.50	15.08
SATVT 2002	17.35	16.35	16.00	13.20	15.73
SATVT 2003	16.70	11.40	11.40	10.10	12.40
SATVT 2004	16.40	14.50	13.25	11.55	13.93
SATVT 2005	17.50	16.30	16.20	13.45	15.86
SATVT 2006	17.20	16.45	16.15	16.05	16.46
SATVT 2007	20.15	13.45	14.15	11.35	14.78
SATVT 2008	20.10	19.25	13.10	12.50	16.24
SATVT 2009	17.55	16.45	13.30	11.35	14.66
SATVT 2010	18.30	16.40	16.10	11.15	15.49
SATVT 2011	19.65	16.25	16.25	16.15	17.08
SATVT 2012	17.35	16.20	16.05	15.30	16.23
SATVT 2013	20.50	20.45	20.10	20.05	20.28
SATVT 2014	18.00	16.50	16.25	13.25	16.00
SATVT 2015	19.30	19.05	18.40	18.20	18.74
SATVT 2016	16.50	17.30	11.25	11.30	14.09
SATVT 2017	18.25	16.30	16.40	10.30	15.31
SATVT 2018	17.55	16.40	11.30	10.25	13.88
SATVT 2019	19.15	16.25	16.10	16.10	16.90
SATVT 2020	16.40	16.10	15.30	15.45	15.81
SATVT 2021	16.45	11.15	10.10	11.15	12.21
SATVT 2022	21.30	21.20	21.30	20.25	21.01
SATVT 2023	18.45	17.30	16.65	14.55	16.74
SATVT 2024	18.25	11.30	11.45	10.00	12.75
SATVT 2025	18.90	17.10	17.20	16.45	17.41
SATVT 2026	18.40	16.30	16.05	13.55	16.08
SATVT 2027	18.55	13.30	14.15	13.20	14.80
SATVT 2028	16.30	16.10	16.30	10.35	14.76
SATVT 2029	16.45	13.30	11.50	10.20	12.86
SATVT 2030	16.35	13.30	13.10	13.30	14.01
BR 153	17.25	16.50	16.25	11.50	15.38
CO 43	24.55	23.10	23.05	20.45	22.79
ADT 38	18.70	17.45	16.10	15.30	16.89
ADT 39	18.30	18.30	16.30	11.60	16.13
IR 20	17.35	16.35	11.30	10.10	13.78
CR 1009	20.30	19.30	18.45	17.50	18.89
Main plot mean	18.25	16.36	15.35	13.53	
CD (P=0.05)					
Main	0.19**				
Sub	0.20**				
S x M	0.39				
M x S	0.51				

Table 2. Effect of soil types and sources of irrigation on grain yield (g hill^{-1}) in 36 rice genotypes

Genotype	NS+NW	NS+SW	SS+NW	SS+SW	Sub-plot mean
SATVT 2001	9.70	8.95	7.90	7.20	8.44
SATVT 2002	8.55	8.40	8.00	7.20	8.04
SATVT 2003	11.10	9.80	8.60	9.05	9.64
SATVT 2004	8.75	8.30	8.20	7.20	8.11
SATVT 2005	10.10	9.50	9.00	8.05	9.16
SATVT 2006	10.05	8.60	8.55	8.25	8.86
SATVT 2007	9.65	9.10	8.45	7.15	8.59
SATVT 2008	9.55	8.90	8.75	7.90	8.78
SATVT 2009	10.10	9.35	8.65	8.55	9.16
SATVT 2010	10.40	10.15	9.30	8.15	9.50
SATVT 2011	8.45	8.15	7.40	7.10	7.78
SATVT 2012	8.55	8.45	8.30	7.40	8.18
SATVT 2013	13.50	13.20	13.00	12.25	12.99
SATVT 2014	9.10	8.45	8.01	8.20	8.44
SATVT 2015	11.45	10.25	10.50	9.55	10.44
SATVT 2016	9.55	8.65	8.00	7.10	8.33
SATVT 2017	9.70	9.25	9.15	8.70	9.20
SATVT 2018	9.75	8.30	7.75	7.75	8.39
SATVT 2019	11.10	10.20	10.65	9.05	10.25
SATVT 2020	11.45	11.15	10.25	10.05	10.73
SATVT 2021	9.25	8.30	7.75	7.45	8.19
SATVT 2022	12.45	12.20	11.80	12.10	12.14
SATVT 2023	9.20	9.40	8.85	7.80	8.81
SATVT 2024	10.40	9.55	8.75	8.25	9.24
SATVT 2025	10.25	9.55	9.40	8.50	9.43
SATVT 2026	8.75	8.30	7.35	7.00	7.85
SATVT 2027	9.50	9.10	8.45	7.65	8.68
SATVT 2028	9.80	8.90	8.85	7.35	8.73
SATVT 2029	9.85	9.55	9.15	9.15	9.43
SATVT 2030	9.10	8.85	8.40	8.00	8.51
BR 153	9.40	9.15	8.45	8.05	8.76
CO 43	12.55	12.40	12.05	11.75	12.19
ADT 38	9.70	9.45	8.90	8.30	9.09
ADT 39	9.55	8.90	8.45	7.25	8.54
IR 20	9.70	9.25	9.10	8.55	9.15
CR 1009	12.05	11.15	10.15	10.10	10.86
Main plot mean	10.06	9.47	9.01	9.54	
CD (P=0.05)					
Main	2.66*				
Sub	4.60**				
S x M	9.20				
M x S	5.00				

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CO 3 GROUNDNUT, A PREDICTABLE LEGUME

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ABSTRACT

The new groundnut variety CO 3 is a hybrid derivative of VRI 3 (VG 55) X JL 24 with desirable attributes Viz., high yielding and bold kernel (HPS) type coupled with moderate resistance to bud necrosis. This matures in 105 days. It gives an average yield of 1750 and 2150 kg/ha under rainfed and irrigated conditions respectively.

KEY WORDS: Groundnut, Variety, Adaptive Research Trial.

Groundnut (*Arachis hypogaea* L.) is one of the important oilseed crops of Tamil Nadu and grown in 11 lakh ha annually. Though many high yielding varieties have been released for general cultivation, there was a long felt need for a bold seeded variety coupled with high yield for export market. This long felt need had been satisfied by the release of this CO 3 groundnut for general cultivation.

MATERIALS AND METHODS

Hybrid combination was made during 1992 involving the parents VRI 3 (VG55) X JL 24 and pedigree breeding was followed to select the best derivatives. One such derivative was designated as TNAU 256 after its superiority was found in initial varietal trials during 1994-95 and 1995-96. It has been evaluated extensively under multilocation trials (9centres), adaptive research trials (ART 39 in rabi / summer (irrigated) and 46 in Kharif (rainfed) and in All India coordinated programme during 1994-1998.

The evaluation was carried out during kharif and rabi seasons with the checks CO 2 and VRI 2. The biometrical observation on plant stand (initial and final), days to initial and 50 per cent flowering, dry pod yield, kernel yield, oil content, and 100 kernel weight were recorded. The culture TNAU 256 was also tested for its reaction to bud necrosis, leaf spot and rust.

RESULTS AND DISCUSSION

The culture TNAU 256 was tested for its yield potential both under rainfed (kharif) and irrigated (rabi/summer) conditions at Coimbatore, University Research Stations, All India Coordinated testing centres and also in cultivators holdings (Adaptive