

Salinity Effect on the Germination and Early Vigour of Five *Sorghum* Varieties

by

R. KALIAPPAN¹ and A. RAJAGOPAL².

Introduction : The degree of saline tolerance of crops varies with species and varieties. Germination being a critical stage of plant growth, many investigators reported retardation in germination and growth of seedlings due to higher salinity levels. The varietal difference in saline tolerance will be a useful source of selection of tolerant varieties. Sorghum has been classified as a medium tolerant crop to salinity (Richards, 1954). Yet, only a meagre knowledge is available on the salt tolerance of South Indian *Sorghum* varieties. The present study is devoted to an investigation on the response of five varieties of *sorghum* to salinity in the early stage.

Materials and Methods : Seeds of five varieties of *sorghum* were selected for uniform size, shape and grouped in lots having 50 seeds per lot. The varieties included are Co. 18, Co. 19, Co. 20, CSH.1 and CSH.2. The basis for selection of these five varieties is their importance in the cultivation in Tamil Nadu (Madras). The seeds were sown in soil with a pH 7.6 and EC 0.2 m.mhos per cm at 25°C. Soil was weighed into a quarter sized pot capable of holding 2.5 kg of soil. There were five treatment viz., (1) Rain water (control), (2) 2000 ppm (3) 4000 ppm (4) 6000 ppm and (5) 8000 ppm of equal amount of sodium chloride and calcium chloride dissolved in rain water to bring the desired concentration taking the total soluble salts of 300 ppm in rain water. Seeds were sown in the pot at the rate of 50 seeds per pot. Irrigation was given with the rain water and saline solution for the control and treatments respectively. Germination was recorded on the 10th day of sowing. Seedlings with well developed radicle were alone selected as germinated seeds. The root length and the shoot height were also recorded. Seeds were weighed in lots of 100 and soaked in the saline solution as per the treatments and in rain water to find out the absorption of substrate in different concentrations. After 12 hours, seeds were taken out, water particles were removed, weighed and the increase in weight has been reported as absorption of water. The data were statistically analysed.

Result and Discussion : The effect of salinity on the germination is presented in Table 1 as percentage over control. There was a progressive decrease in germination due to increased salt concentration.

1. Reader in Agronomy, 2. Fundamental Research Assistant, Agricultural College and Research Institute, Coimbatore.

TABLE 1. *Effect of salinity on germination (Values are presented taking the control as 100).*

Sorghum Varieties	Treatments				
	Rain water (C)	2000 ppm (T1)	4000 ppm (T2)	6000 ppm (T3)	8000 ppm (T4)
Co. 18 (V1)	100.0	102.1	95.8	59.6	36.1
Co. 19 (V2)	100.0	95.2	87.3	44.4	22.2
Co. 20 (V3)	100.0	104.3	75.6	48.8	41.4
CSH. 1 (V4)	100.0	88.9	68.0	37.5	18.0
CSH. 2 (V5)	100.0	80.4	67.9	21.4	14.3

Whether significant (at P=0.05) : Yes (for treatments, varieties and interaction)

S. E. = 1.3 C. D. = 2.86

Conclusion :

V1	<u>T1</u>	<u>C</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>
V2	<u>C</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>
V3	<u>T1</u>	<u>C</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>
V4	<u>C</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>
V5	<u>C</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>

The data on shoot height and root length are presented in Tables 2 and 3 respectively.

TABLE 2. *Shoot height of 10 days old seedlings (cm.)*

Sorghum Varieties	Treatments				
	Rain Water (C)	2000 ppm (T1)	4000 ppm (T2)	6000 ppm (T3)	8000 ppm (T4)
Co. 18 (V1)	5.71	5.43	5.02	3.44	1.85
Co. 19 (V2)	4.72	5.11	5.18	3.06	1.52
Co. 20 (V3)	6.08	5.57	4.74	3.25	2.05
CSH. 1 (V4)	7.55	6.67	5.38	3.14	1.41
CSH. 2 (V5)	7.11	5.41	4.17	1.40	1.91

Whether significant (at P=0.05) : Yes (for treatments, varieties and interactions)

S. E. = 0.60 C. D. = 1.24

Conclusion :

V1	<u>C</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>
V2	<u>T2</u>	<u>T1</u>	<u>C</u>	<u>T3</u>	<u>T4</u>
V3	<u>C</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>
V4	<u>C</u>	<u>T1</u>	<u>T2</u>	<u>T3</u>	<u>T4</u>
V5	<u>C</u>	<u>T1</u>	<u>T2</u>	<u>T4</u>	<u>T3</u>

TABLE 3. *Root length of 10 days old seedlings (cm)*

<i>Sorghum</i> Varieties	Treatments				
	Rain water (C)	2000 ppm (T1)	4000 ppm (T2)	6000 ppm (T3)	8000 ppm (T4)
Co. 18 (V1)	28.47	27.52	25.97	17.48	9.32
Co. 19 (V2)	24.27	22.93	24.78	16.84	7.40
Co. 20 (V3)	25.33	30.95	27.13	16.05	10.95
CSH. 1 (V4)	30.48	32.80	24.88	13.17	10.34
CSH. 2 (V5)	26.45	26.08	21.12	8.05	8.87

Whether significant at P=0.05 Yes (for varieties and treatments).

Conclusion.

Treatments T1 C T2 T3 T4

The rate of absorption of water from a saline medium for 12 hours is presented in Table 4.

TABLE 4. *Absorption of water from a saline medium (Values in percentage).*

<i>Sorghum</i> Varieties	Treatments				
	Rain water (C)	2000 ppm (T1)	4000 ppm (T2)	6000 ppm (T3)	8000 ppm (T4)
Co. 18	31.3	30.2	30.4	29.5	29.2
Co. 19	31.4	28.5	28.9	28.1	29.6
Co. 20	33.4	32.7	32.6	31.9	31.6
CSH. 1	40.7	37.3	37.8	38.6	38.3
CSH. 2	36.4	36.1	36.7	37.9	35.6

An insight in the data on germination revealed that salinity affected the germination in all the five *sorghum* varieties tested. The salt effect in conditioning the germination was not observed upto the concentration of 4000 ppm., since the treatments control, 2000 ppm and 4000 ppm were on a par. The treatments receiving 6000 ppm and 8000 ppm had differed from other treatments and with each other indicating that germination was highly influenced at the salt concentration of 6000 ppm and 8000 ppm. From the result of shoot height and root length it is found that early vigour of *sorghum* seedlings was not affected upto a salt level of 4000 ppm. The treatments receiving 6000 ppm and 8000 ppm significantly decreased the early vigour. The varietal difference to salinity was not recorded for germination and early vigour.

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The rate of absorption (Table 4) in *sorghum* seeds for 12 hours was not significantly varying due to treatments. However, the absorption was highest in control when compared to the treatment receiving 8000 ppm. The moisture absorption was at the variable rate by different varieties

The reduction in germination and early vigour is attributed to the osmotic concentration of the soil solution and to the toxicity of the ions in the media. The present findings fall in line with the results reported by Ota and Yasue (1958) on rice, Kurian and Iyengar (1966) on *Sesamum*, Varghese and Thambi (1966) on rice that germination was influenced by salinity. Abichandani and Bhatt (1965) reported similar results in *Pennisetum typhoides* and *Sorghum vulgare*.

Summary and Conclusion : A study was undertaken to assess the effect of salinity on germination and early vigour of five *sorghum* varieties with the treatment of Rain water (300 ppm-Control), 2000 ppm, 4000 ppm, 6000 ppm and 8000 ppm. The results on germination and early vigour (shoot height and root length) indicated that *sorghum* varieties were not affected upto a salt level of 4000 ppm. A salt concentration of 6000 ppm and above was found to be detrimental. The reduction in germination and early vigour is attributed to the osmotic concentration of the substrate and the ionic effect of the salts. It is concluded that *sorghum* is a fairly tolerant crop under salinity and up to a salt concentration of 4000 ppm the germination and early vigour are not affected.

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