

Effect of Salinity on the Germination and Growth of Sorghum Varieties at Seedling Stage

By

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ABSTRACT

Artificial salinisation resulted in a reduction in germination in sorghum varieties. The seedling growth was much effected by salinity, while the tolerant varieties exhibited better growth and tolerance particularly with ageing. The reduction in dry matter production due to salinity was well pronounced in all the sorghum varieties and it is evident that the final yield would be affected to the same extent.

INTRODUCTION

Like most of the cereals, the varieties of sorghum also show varied degree of tolerance to salinity. Our soils in most of the regions of the State show slow increase in salinity and alkalinity. It will be desirable to select tolerant varieties by screening them by a simple method. The object of this study is to screen twenty sorghum varieties for their salt tolerance based on the effect of salinity on the germination and growth.

MATERIALS AND METHODS

Twenty varieties of sorghum were tested for germination, shoot length, root length and dry matter production in salt concentrations ranging from 1000 to 5000 ppm. (NaCl : CaCl₂ 1 : 1) Red soil with an E. C. of 0.1 and pH 7.5 were used for experiments. The germination was assessed on 10th day, while shoot length, root length and dry matter production were recorded on 10, 20 and 30 days after sowing.

RESULTS AND DISCUSSION

The germination percentage at chosen salinity levels indicated that irrespective of the variety, salinity reduced the germination. The sorghum varieties differed in their ability to resist salt concentration. It is seen from the Table 1 that E. 574, E. 1075 and E. 1212 were susceptible to salinity. The varieties CO 12, CSH 1, E 699, E 771, K 3, and K 4. were found to be tolerant to salinity in comparison to other varieties.

The repidity of germination also faced a reduction in high salinity levels, which has been observed earlier in wheat by Asana and Kale (1956) and in sorghum by Varadinov (1968). It has also been shown that the retarding effect of salt solution on the germination of seed is in direct proportion with osmotic pressure, when the solutions are strong.

As regards the root length, it was seen that the root length progressively

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TABLE 1. Germination percentage of tolerant, moderately tolerant and susceptible varieties

	Salt concentration (ppm)					
	Control	1000	2000	3000	4000	5000
Tolerant varieties	98.0	96.0	92.0	78.0	57.0	40.0
Moderately tolerant varieties	95.0	92.0	87.0	62.0	30.0	24.00
Susceptible	92.0	75.0	66.0	55.0	23.0	14.0

Mean : 26.08 ; S. E. : 1.67

M + 2 S. E. = 30.42

M - 2 S. E. = 22.74

got reduced corresponding to increasing salinity levels (Table 2). Characteristic blackening was observed at the neck region at higher salinity doses. The tolerant varieties recorded better root development as compared to susceptible varieties. The effect of treatments was less severe at 30 days stage indicating that, some amount of resistance has been incorporated with ageing. Similar observations have been recorded by

Kwai *et al.* (1967) in rice and Younis and Hatta (1972) in wheat. The shoot length was affected greatly corresponding to salt concentration (Table 3). The shoot development was progressively reduced as the concentration of the saline solution increased. At 5000 ppm, the tolerant varieties showed better shoot growth than the other varieties. Greenway (1962) in his experiments on barley

TABLE 2. Shoot length of a tolerant, a moderately tolerant and a susceptible varieties (10 days stage) in cms

	Salt concentration (ppm)					
	Control	1000	2000	3000	4000	5000
Tolerant variety	17.9	14.5	9.9	6.6	5.4	4.0
Moderately tolerant variety	18.5	15.6	10.4	8.2	4.6	3.6
Susceptible variety	13.6	12.0	5.8	6.1	1.2	1.0

Treatments : S. E. of mean \pm 2.15 ; C. D. 6.02

Mean : 56.54

S. E. : 2.536 ; M + 2 S. E. : 61.612

M - 2 S. E. = 51.468

Treatments : \bar{C} , \bar{T}_1 , \bar{T}_2 , \bar{T}_3 , \bar{T}_4 , \bar{T}_5 Stages : S_3 , S_2 , S_1 ,

TABLE 3. Root length of a tolerant, a moderately tolerant and a susceptible variety (10 days stage) in cms

	Salt concentration (ppm)					
	Control	1000	2000	3000	4000	5000 ppm
Tolerant variety	17.2	12.1	6.8	6.4	5.0	3.2
Moderately tolerant	12.7	12.8	7.5	4.4	3.4	2.8
Susceptible	13.7	11.2	4.3	3.8	2.1	0.9

Treatments: S. E. of mean 0.18; C. D. 0.504

Mean: 69.510

S. E.: 1.967

M + 2. SE: 74.444

M - 2. SE: 65.576

Treatments: C, T₁, T₂, T₃, T₄, T₅Stages: S₃, S₂, S₁

TABLE 4. Dry matter production of a tolerant, a moderately tolerant and a susceptible variety (10 days stage) in g.

	Salt concentration (ppm)					
	Control	1000	2000	3000	4000	5000
Tolerant	2.16	2.13	2.28	1.56	1.24	0.80
Moderately tolerant	1.32	1.26	1.38	1.14	1.00	0.65
Susceptible	2.86	2.45	1.64	1.55	0.81	0.46

Treatments: S. E. of mean = 0.134; C. D. = 0.347

Mean = 36.31

S. E. of mean = 1.911

M + 2. SE: 40.132

M - 2. SE: 32.488

Conclusions:

Stages: S₃, S₂, S₁Treatments: C, T₁, T₂, T₃, T₄, T₅

varieties, subjected to different salt stress, showed a reduction in growth of vegetative phase and there were pronounced varietal differences. Kaddah and Ghowail (1964) concluded that in rice, the shoot growth was affected due to salinity.

The tolerant varieties, CO 4, CO 12, CO 18, CSH 1 cultures E 699, E 771, K 3 and K 4 produced more dry matter at 5000 ppm salt concentration than the other varieties and cultures. The dry matter production was progressively reduced at increasing levels of salinity.

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INTRODUCTION

Sorghum (*Sorghum* (L.) Mill sp.) is the most important pulse crop of Tamil Nadu and occupies an area of about 1,48,800 hectares with an annual production of about 40,280 tonnes of pulse grains (TANON 1975). As a result of earlier work COI sorghum an intro- ved variety maturing in 125 days was released (Veeravarny and Ramesh Babu 1973). Further attempts made in Tamil Nadu Agricultural University, Coimbatore to evolve still superior variety shorter in duration and higher yielding than COI with an intro- ved plant type suitable for rainfall and irrigated conditions have resulted in the release of COI sorghum. The develop- ment of this new variety and its salient features are described below.

MATERIALS AND METHODS

Research project on evolution in short duration coupled with high