

Effect of Salinity on the South Indian Field Crops—Duration and Grain setting in Ragi (*Eleusine coracana Gaertn.*)

by

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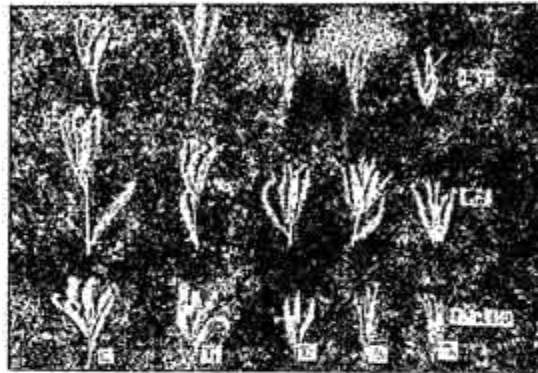
Introduction: The osmotic concentration of the soil solution and the toxicity of the ions in the media influence the physiological functions of the plant. Growth, tillering, flowering and yield are affected due to saline condition. The root elongation is also limited with increased salinity. In the present study an attempt is made to evaluate the salinity effect on the duration from sowing to panicle emergence and grain setting percentage in ragi.

Review of Literature: Marshall (1942) reported that barley is the crop most likely to succeed in saline soil and found a good stand and somewhat delayed maturity in soil containing 1.6 per cent of mixed salts of sodium chloride and magnesium sulphates. Doughty and Stalwick (1940) observed 0.4 per cent of water soluble salts as the approximate upper limit of fair crop growth for oats and wheat. There was reduction in yield of 33 to 77 per cent. Addition of 5700 ppm. sodium chloride on a dry soil basis prevented grain formation but resulted in only a slight decrease in the production of straw in rice (Kapp 1947). Heading and earlength were markedly reduced in plants irrigated at the earlier and middle stage of ear formation, while irrigation in the heading stage resulted in serious reduction in the number of grains per head (Hayward and Bernstein 1958). The yield of corn, beans and millets were reported to be reduced due to salinity. A delay in flower bud formation of tomato has been reported by Hayward and Long (1941). Salt treatments retarded flower bud development, anthesis of flowers and rate of setting of bolls in flax (Hayward and Spurr 1944). Balasubramanian (1965) observed reduction in the grain setting percentage and delay in duration from sowing to anthesis with increased salinity in rice varieties.

Materials and Methods: The experiment was conducted with three varieties of ragi viz. Co. 7, Co. 8 and ECW. 840. The nursery was raised using rain water for irrigation. The soil selected for the investigation was a red loam with an E. C. of 0.6 m. mhos per centimeter and pH of 7.8. Soil excluding pebbles and stones was weighed into the pot at the rate of 10 kg per pot. The treatments included four salt levels besides irrigation with rain water (control) as indicated below: (1) Rainwater (2) 2000 (3) 4000

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(4) 6000 and (5) 8000 ppm. Different saline concentrations were prepared by dissolving sodium chloride and calcium chloride on 1:1 ratio taking the total soluble salts of 300 ppm. in rain water. There were three replications. All the treatments received a basal dose of farm yard manure at the rate of 10 tons per acre and N, P₂O₅, K₂O at the rate of 40, 20, 20 lb. per acre. Three plants were maintained per pot. The result was also statistically analysed.



Size of earhead and grain setting in relation to salinity.

Result and Discussion: The duration from sowing to panicle emergence is presented in table 1. The duration increased with increased salt level. All the three varieties were influenced by salinity and consequently the duration was prolonged. The effect of salinity in prolonging the duration was at a higher magnitude in the longer duration variety ECW. 840 than in the other two varieties.

TABLE 1. *Effect of salinity on the duration from sowing to flower emergence.*

(Duration in days)

| No. | Treatments Variety | Rainwater C | 2000 ppm. T 1 | 4000 ppm. T 1 | 6000 ppm. T 3 | 8000 ppm. T 4 |
|-----|--------------------|-------------|---------------|---------------|---------------|---------------|
| 1. | Ragi Co. 7 (V1) | 78.55 | 79.78 | 79.77 | 84.61 | 84.66 |
| 2. | Ragi Co. 8 (V2) | 63.77 | 69.66 | 74.77 | 78.22 | 78.66 |
| 3. | Ragi ECW. 840 (V3) | 85.66 | 96.88 | 98.11 | 117.74 | 128.99 |

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

S. E. = 2.34

C. D. = 6.76.

| | | | | | |
|----------|------------|------------|------------|------------|---|
| Co. 7 | <u>T 4</u> | <u>T 3</u> | <u>T 1</u> | <u>T 2</u> | C |
| Co. 8 | <u>T 4</u> | <u>T 3</u> | <u>T 2</u> | <u>T 1</u> | C |
| ECW. 840 | <u>T 4</u> | <u>T 3</u> | <u>T 2</u> | <u>T 1</u> | C |

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The grain setting under different salinity levels are presented in Table 2. The grain set decreased with increased salinity levels.

TABLE 2. *Effect of salinity on the percentage of grain setting in ragi.*

| No. | Treatment Variety | Rainwater C | 2000 ppm. T 1 | 4000 ppm. T 2 | 6000 ppm. T 3 | 8000 ppm. T 4 |
|-----|--------------------|-------------|---------------|---------------|---------------|---------------|
| 1. | Ragi Co. 7 (V1) | 88.636 | 83.131 | 71.200 | 72.698 | 57.524 |
| 2. | Ragi Co. 8 (V2) | 96.404 | 89.447 | 69.435 | 52.903 | 54.278 |
| 3. | Ragi ECW. 840 (V3) | 81.658 | 75.651 | 57.395 | 35.586 | 15.002 |

Whether statistically significant at $P=0.05$: Yes. (For treatments, varieties and interaction).

S. E. = 3.02, C. D. = 9.247

| <i>Treatments</i> | <i>Varieties</i> |
|--|---------------------------------------|
| V1: $\overline{C \quad T1 \quad T3 \quad T2 \quad T4}$ | C: $\overline{V2 \quad V1 \quad V3}$ |
| V2: $\overline{C \quad T1 \quad T2 \quad T4 \quad T3}$ | T1: $\overline{V2 \quad V1 \quad V3}$ |
| V3: $\overline{C \quad T1 \quad T2 \quad T3 \quad T4}$ | T2: $\overline{V1 \quad V2 \quad V3}$ |
| | T3: $\overline{V1 \quad V2 \quad V3}$ |
| | T4: $\overline{V1 \quad V2 \quad V3}$ |

The data on the duration from sowing to panicle emergence indicated that salinity influences the duration. Among the three varieties under investigation Co. 7 was not much affected by salinity. In the case Co. 8. the treatments receiving 4000 ppm., 6000 ppm., and 8000 ppm. have significantly differed from control and recorded increased duration due to salinity. The variety ECW. 840 was much influenced by salinity. The lengthening of duration from sowing to panicle emergence is attributed to the physiological disturbances induced by salinity which varies with varieties. The present findings are in line with Hayward and Long (1941) and Balasubramanian (1965) who have reported delayed flower bud formation in tomato, delay in duration in rice due to salinity, respectively.

The effect of salinity on the grain setting in ragi revealed that the salinity influenced the grain setting. There was a progressive reduction in the number of grains with increased salinity. The variety ECW. 840 was much influenced by salinity than the other [two varieties Co. 7, and Co. 8. It is event from the Plate that there is a distinct reduction in the size of earhead as well as setting of grains in treatments

4000 ppm. and above in all the three varieties. The reduction in the grain setting may be due to the physiological disturbances which might get reflected in functioning capacity of the gametes, a test for this is possible only by studies relating to embryology and physiology. The present investigations fall in line with Doughty and Stalwick (1940) that addition of 5700 ppm. sodium chloride prevented grain formation and resulted in slight reduction in the production of straw in rice. Hayward and Bernstein (1958) observed that irrigation of salt water at the heading stage resulted in serious reduction in the number of fertilized grain per head. Balasubramanian (1965) reported similar results in rice.

Summary and Conclusions: A study was undertaken to assess the effect of salinity on the duration and grain setting in ragi (*Eleusine Coracana*) in which five treatments were included viz. rainwater (control), 2000, 4000, 6000, and 8000 ppm. of chlorides of sodium and calcium. Three varieties of ragi viz. Co. 7, Co. 8 and ECW. 840 were tried. The duration from sowing to panicle emergence increased with increased salt concentration. Variety ECW. 840 was much affected by salinity and Co. 7 was least affected. The grain setting was progressively decreased due to increased salinity levels. All the three varieties were influenced by salinity, and resulted in the reduction of grain setting. Variety ECW. 840 was much influenced and the varieties Co. 7 and Co. 8 could not be differentiated in their ability to tolerate the salinity. The variety ECW. 840 was highly sensitive to salinity and showed prolonged duration from sowing to panicle emergence and reduction in grain setting.

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