THE EFFECT OF SALINITY ON THE GERMINATION OF 17 RICE VARIETIES

By

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INTRODUCTION

Rice is considered one of the most sensitive crops to salinity (Pearson 1959, 1960, Kaddah 1959, 1960), especially after the emergence state during the seedling period (Kaddah and Barakat 1959). Varietal behaviour towards salinity effects has been found by the above workers and many others. Selection for salinity tolerance is becoming therefore an active field of work, especially for regions depending on supplementary irrigation.

Since 1958 co-operation between the Rice Section and the Soil Salinity Laboratory of the Ministry of Agriculture has been carried for such ends. For the present work, at the request of the Rice Section 17 rice varieties and crosses were tested for germination under different salinities for the purpose of nursery size or sowing rate as well as for selection.

MATERIALS AND METHODS

Under greenhouse conditions in April 1968 different rice varieties and crosses, in shallow glazed pots of clay loam soil (100 seeds each) were subjected to continuous supply of different salinized water, (Drainage free). Varieties and crosses were : Nahda, Giza 159, Cr 206/12, Cr 205/56, Cr 206/142, Cr 206/105, Agami Montachab No 1, Yna 108, Cr 212/1/1, Cr 206/27 Cr 206/29, Cr 206/71, Cr 206/121, Cr 206/143, Cr 206/147 Cr 206/168 and Phillip., 131.

Six hundred and 1200 p.p.m of NaCl + CaCl 2 in the ratio 19 : 1 comprised two salinity treatments beside that of the control (Tap water of 180 p.p.m).

For each variety or cross 400 and 1200 seeds were taken respectively for the control and each of the two salinity treatments.

Growing seedlings were counted, cut, weighed at the end or 25 days after emergence. Germination percentages were calculated as final counts x 100 relative to the total number of seeds and statistically analysed according to Snedecor 1950.

RESULTS AND DISCUSSION

Table 1 represents the germination percentage for the different rice varieties and crosses under the different salinity treatments. Mean germination percentage, as seen in the table, declines significantly from 78.1 $\pm$ 5.0 to 54.5 $\pm$ 2.2 to 43.6 $\pm$ 2.2 by raising the salinity of the media from 180, to 780 and to 1380 p.p.m respectively. To compensate for the failure due to salinity influence on the rice seed germination or on the ability of the seedlings to stand until the time of transplanting, suitable increment in the nursery size or in the amount of seeds per unit area of the rice soil should be found out. Based on the presented data, such increments for the salinity magnitudes of 780 and 1380 p.p.m, which are not uncommon in soils of the regions utilizing drain or drain river mixed waters, are respectively estimated as 143 and 170% of that normally allocated for salt free conditions.

Germination percentage in the different varieties and their crosses, as shown in the table, deviates significantly from the general mean, at all degrees of salinity. The magnitude of scatter in germination percentages of the different varieties is also variable among different salinities. This would imply a significant interaction between the salinity effect and the plant vitality to germinate or to stand. This would permit the selection for the inherent salt tolerance property in the different varieties. Varieties, therefore and for practical purposes, could be grouped into three classes i.e., high, medium and low, according to their vitality under each of the three salinity conditions. The limits of the three classes under the control salinity may be : high $>$ 83.1% medium between 83.1 and 73% and low $<$ 73.1%. The limits under the 780 p.p.m salinity similarly may be; high $>$ 56.7% medium between 56.7 and 52.3% and low $<$ 52.3%. Those under the 1380 p.p.m salinity are : high $>$ 45.8% medium between 45.8 and 41.4% and low $<$ 41.4%. Reviewing table 1 once again to fit the varieties in the above mentioned classes it is noticed that they distribute among the three classes under the control salinity but among only two classes under each of the other two classes under each of the other two salinity treatments. No variety occurs in the medium class under the added salinity treatments, which is a manifestation of interaction. As the selection is usually based on both vitality and salinity tolerant grounds the cross 206/27 is seen among the best crosses with respect to both properties. For this individual case the required increment in nursery size or sowing

TABLE 1. — **The effect of soil salinity on the germination percentage of 17 rice varieties and crosses (Counting after 25 days of emergence)**

Variety code	Salinity of Irr. water p.p.m. *		
	180 Control	+ 600	1200
Nahda	67.5	38.6	23.1
Giza 159	59.3	46.2	32.3
Cr. 206/12	82.5	49.0	37.3
» » /56	86.8	61.2	52.1
» » /105	55.5	49.2	25.6
» » /142	84.8	41.7	32.8
Agam Mont. No 1	71.5	44.7	29.7
Yna. 108	79.0	40.0	30.1
Cr. 212/1/1	91.8	72.9	63.4
» 206/27	83.4	68.9	60.9
» » /29	89.8	66.8	62.6
» » /71	89.0	63.5	61.0
» /121	83.0	70.9	51.8
» » /143	88.8	69.9	55.3
» » /147	80.0	59.1	48.8
» » /168	80.5	64.9	58.7
Phillip., 131	53.7	23.4	15.8
Mean	78.1 $\pm$ 5.0	54.5 $\pm$ 2.2	43.6 $\pm$ 2.2

* Salinity of irrigation water = salinity of saturation extract of the soil

TABLE 2. — **Mean dry weight of a rice seedling (25 days old) as affected by the salinity of the soil**

Variety code	Salinity of Irr. water p.p.m		
	180 Control	+ 600	1200
	9	9	9
Nahda	.036	.025	.018
Giza 159	.042	.030	.019
Cr. 206/12	.034	.026	.024
» » /56	.049	.044	.029
» » /105	.032	.038	.020
» » /142	.042	.029	.020
Agam Mont. No 1	.035	.027	.021
Yna. 108	.048	.025	.016
Cr. 212/1/1	.060	.044	.036
» 206/27	.053	.042	.036
» » /29	.053	.048	.044
» » /71	.051	.033	.027
» » /121	.048	.038	.031
» » /143	.045	.038	.028
» » /147	.050	.045	.033
» » /168	.059	.048	.036
Phillip., 131	.033	.032	.026
Mean	.045	.036	.027

rate under the highest salinity treatment, would be only 137% of that normally allocated.

Salinity did not only reduce the ability of rice to germinate, but also caused stuntness of the plant, which is apparent in table 2. On the average variety and at the end of the 25-day period of seedling life, reductions of 25 and 67% in plant dry weight were affeted by the 780 and 1380 p.p.m treatments respectively. Varieties, however, did vary in this respect as they did in germination. A correlation test between the germination percentage and the dry weight of plant, generally, proves to be positively significant (r = .699). Whether the variation in germination comes as a salinity or variety effect very nearly the same degree of association between germination and dry weight is obtained (r = 747, 736 and .812) for the 180, 780 and 1380 p.p.m salinity treatments).

Rice plants during seedling time are very tender to salinity effect and care should be taken, especially in the newly reclaimed soils or where drain water is used to supplement irrigation. A short period of upward water movement in the top soil, during rice seedling times, may bring in fatal doses of salt which may not be as such for other crops.

SUMMARY AND CONCLUSION

Seventeen rice varieties and crosses were tested for germination under different salinities for the purpose of nursery size or sowing rate as well as for selection. Six hundred and 1200 p.p.m of NaCl + CaCl 2 in the ratio 19 : 1 comprised two salinity treatments beside that of the control. Seedlings were counted, cut and weighed at the end of 25 days from sowing. Germination percentages were calculated and statistically analysed.

It was found that the mean germinaion percenage declined significantly by raising the salinity of the media. To compensate that failure due to salinity the seeds necessary for nursery or sowing rate should be increased to 143% and 170 % of that normally allocated for salt free conditions for water salinities 780 and 1380 p.p.m respectively.

Interaction between variety and salinity was found significant. The cross 206/27 is considered the best with respect to salinity tolerance. Sowing rate for this individual variety under the highest saline condition is 137%.

Salinity did not only reduce the ability of rice to germinate but also caused stuntness as indicated by the dry weight of the plant. Varieties, however, did vary in this respect as they did in germi

REFERENCES

PEARSON, G.A., L., BERNSTEIN, 1959. — Salinity effects at several growth stages of rice. *Agron., Jour., Vol. 51* (654-657).

PEARSON, G.A., A.E. AYRES, 1960. — Rice as a crop for salt affected soils in process of reclamation *Production Research, Report* No. 43. *Agric., Res., Service U.S.D.A.*

KADDAH, M.T. and S., FAKHRY 1959. — Salt tolerance in Egyptian rice varieties. *Soil Sal., Lab., Minis of Agric., A.R.E., Report.* 1959.

KADDAH, M.T. and S., FAKHRY, 1960. — Salt tolerance in Egyptian rice varieties. *Soil Sal., Lab., Minis.of Agric., A.R.E. Report* 2. 1860.

KADDAH, M.T. and M.A., BARAKAT, 1959. — Utilization of brakish water in rice production. *Cereal conf., Res. Coun.*, 1959.

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