Salinity tolerance in japonica rice

Kyu-seong Lee[1], D.Senadhira[2] and Soo-yeon Cho[1]

[1] National Honam Agricultural Experiment Ststion(NHAES)
[2] Internaional Rice Research Institute(IRRI), Philippines

1. Objective

To determine the variability for salinity tolerance in japonica rice

2. Materials and Methods

A total of 657 traditional and improved japonica varieties from China, Egypt, Indonesia, Japan, Korea, Philippines, and Senegal were tested. Indica varieties IR29 and Pokkali were used as checks.

Twelve-day-old seedlings were grown in a salinized solution, initially at EC of 6 dSm^{-1} for four days followed by an EC of 12dSm^{-1} for 20days. Stress symtoms of each plant were scored using an evaluation system and a physiological parameters, seedling height, dry shoot weight, dry root weight, were measured and samples were analyzed for Na^+ and K^+ concentraion in the shoot.

3. Results

- Large variation in salinity tolerance among japonicas was detected.
- Nineteen tolerant varieties were identified.
- Tolerant varieties absorbed less Na^+ and maintained a low Na^+ and Na-K ratio in the shoot
- Shoot K^+ concentration did not show any relationship with salinity tolerance.
- Tolerance level of Pokkali(Indica) was higher than the best japonica identified since it absorbed significantly less Na^+ and very high amounts of K^+.

Table: A modified standard evaluation system for salt tolerance at seedling stage in japonica rice.

OBSERVATION	SCORE	TOLERANCE DEGREE
Normal growth of seedlings, no leaf symptoms	1	Tolerant
Growth reduced slightly, leaf tips discolored, old leaves are drying	3	Tolerant
Growth reduced, leaf blades discolored, old leaves dry, other leaves are rolling	5	Moderate
Growth reduced severely, all leaves discolored, and dying	7	Susceptible
Seedlings dead or dying	9	Susceptible

Table Varietal differences in percent reduction in height, dry shoot weight, and dry root weight, and shoot concentration of Na^+, K^+, and Na-K ratio of 16 japonica varieties and the two check varieties.

Group[1]	Variety	Reduction			Shoot conc. (%)		Shoot Na-K Ratio
		Height	Shoot weight	Root weight	Na	K	
T	Agami M1	42.50def	30.30a	63.15bcd	1.48bc	1.67b-e	0.89bc
	Nanyang 7	25.63a	41.18ab	55.20ab	1.39b	1.87e	0.74b
	Gaori	37.98bcd	45.85abc	69.95bcd	1.69bcd	1.56a-e	1.08b-e
	Diangen No. 8	38.40bcd	41.08ab	58.73bc	1.62bcd	1.69cde	0.96bcd
	GZ2447-5-17	40.55cde	47.75a-d	63.83bcd	1.70de	1.41abc	1.21c-f
Group mean		37.21	42.83	62.17	1.58	1.64	0.96
M	Dongpao	41.90def	56.83def	77.78de	2.26ef	1.76cde	1.28e-f
	Yunlen 11	37.23abc	66.18fg	74.83cde	1.89de	1.44a-d	1.31def
	Yunlen 12	35.37cd	54.78cde	75.58cde	1.88de	1.64a-e	1.15c-f
	Akihikari	41.73cf	49.53bcd	80.15de	1.81cd	1.50a-d	1.20c-f
	Tanao-tao	37.50bcd	41.33ab	66.68bcd	1.92de	1.65a-e	1.16c-f
Group mean		38.75	53.73	75.00	1.95	1.60	1.22
S	Daegudo	40.60cde	61.20efg	89.55e	2.32f	1.32ab	1.76gh
	Yeosudo	48.33d-g	68.33gh	75.70cde	2.26ef	1.61a-e	1.40efg
	Lori	52.78fg	78.63hi	74.64cde	2.85gh	1.29a	2.21i
	Jinling 78-102	46.63def	69.15gh	79.97de	2.76g	1.79de	1.54fgh
	Guton	51.85efg	84.40i	89.07e	3.18h	1.43a-d	2.22i
	Qiygallotgot	40.18cd	49.08a-d	73.97cde	2.22cf	1.50a-d	1.48fgh
Group mean		46.73	68.47	80.48	2.60	1.49	1.75
Pokkali (check)		25.15a	40.68ab	40.68a	0.97a	2.79f	0.35a
IR29 (check)		58.60g	71.10gh	88.28e	2.39f	1.31ab	1.80h

[1] T = Tolerant, M = Moderately tolerant, S = Susceptible
Means followed by a common letter in a column are not significantly different at the 5% level by DMRT.

Table Correlation matrix of tolerance parameters.

Parameter[1]	Parameter				
	RSW	RRW	Shoot Na	Shoot K	Shoot Na-K Ratio
RPH (%)	0.644°	0.556°	0.765°°	-0.380	0.740°°
RSW (%)		0.743°°	0.897°°	-0.453	0.868°°
RRW (%)			0.769°°	-0.475	0.730°°
Shoot Na (%)				-0.380	0.925°°
Shoot K (%)					-0.682°°

[1] RPH = Reduction in plant height
RSW = Reduction in shoot weight
RRW = Reduction in root weight

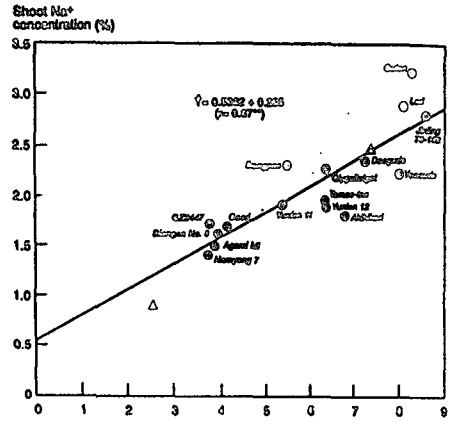

Fig. The estimated linear regression between shoot Na^+ concentration and visual score for salt tolerance in japonica rice. Position of indica check varieties not included in analysis are shown: Pokkali (tolerant) = △, and IR29 (susceptible) = ▲.

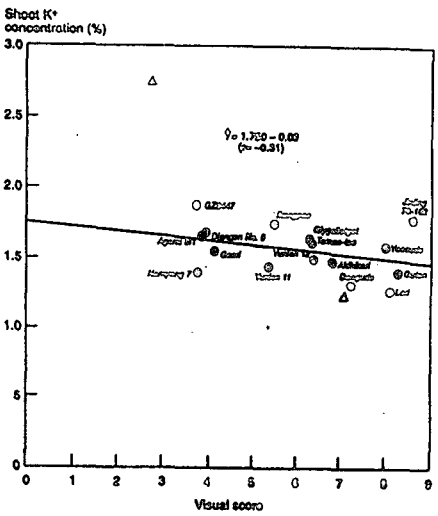

Fig. The estimated linear regression between shoot K^+ concentration and visual score for salt tolerance in japonica rice. Position of indica check varieties not included in analysis are shown: Pokkali (tolerant) = ▲, and IR29 (susceptible) = △.